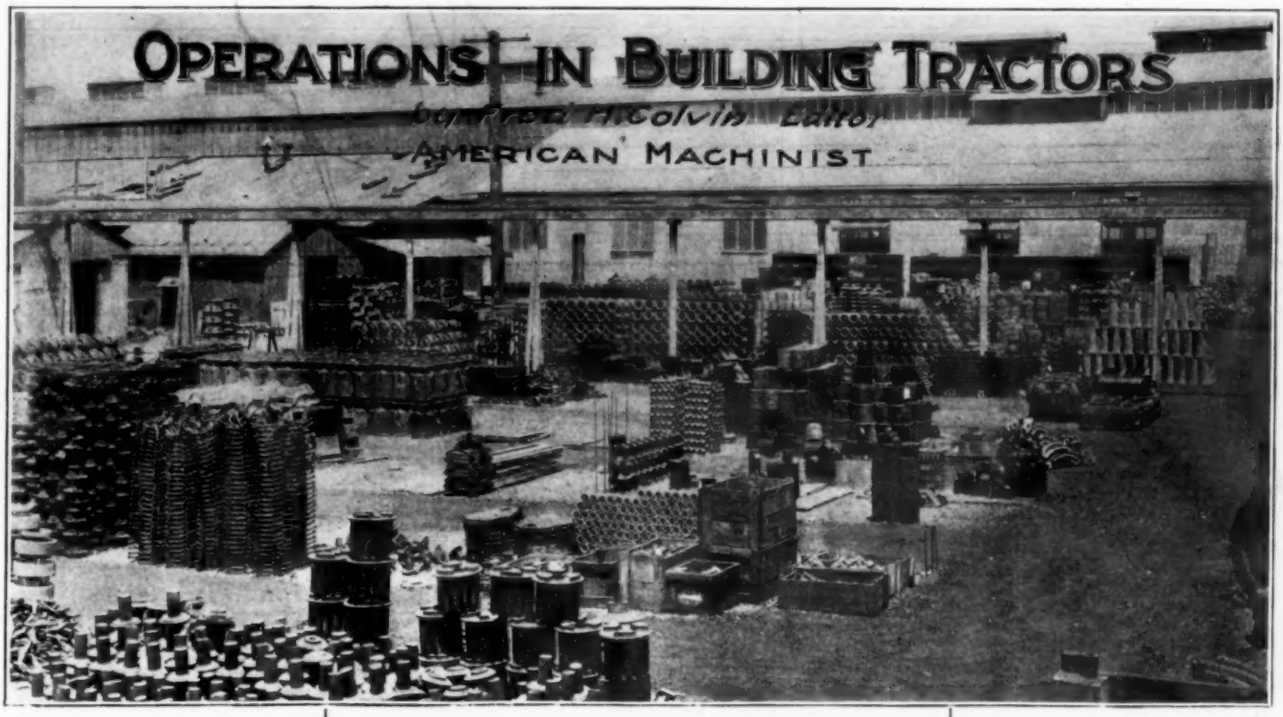
November 11, 1920 American Machinist Vol. 53, No. 20



Some idea of the increases of manufacturing on the Pacific Coast can be had by a visit to the plant of the C. L. Best Gas Traction Co. at San Leandro, California. A number of the machining operations are of unusual interest while the material storage yard shown in the headpiece gives an excellent idea, both of the varied parts of the products and the orderly arrangement, which is not only pleasing to the eye, but makes it easy to find exactly the piece wanted.

THE orderly arrangement of the yard indicates the type of mind which pervades the management. Such a yard has its effect on the personnel of the whole shop and can hardly help being reflected in the products. This company builds large track-laying tractors which are in ever-increasing demand. The rear-axle housing is one of the very important units in heavy tractor work. The housing is a large steel casting and can be seen in various stages of construction in Figs. 1 to 8. One of the first operations is the planing of the top and sides on the Cincinnati planer shown in Fig. 1, which shows the type of fixtures used, the method applied in centering the opening for the axle, the locating screws and the method of strapping the casting to the fixture itself.

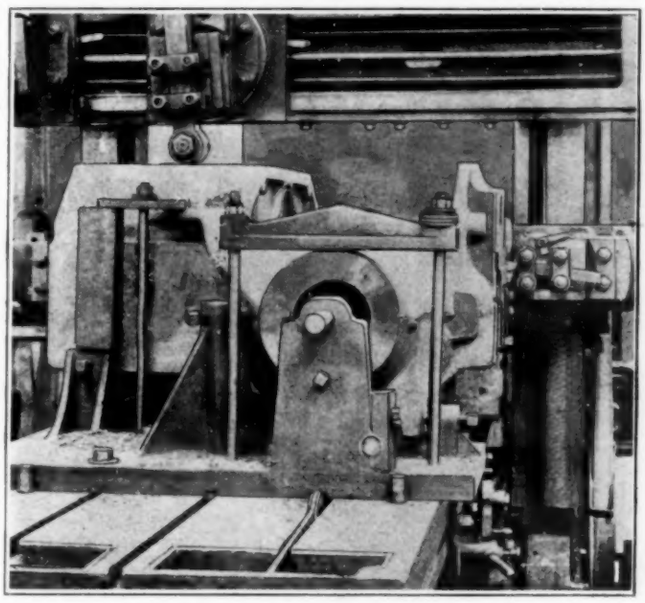


FIG. 1. PLANING THREE SIDES OF REAR-AXLE HOUSING

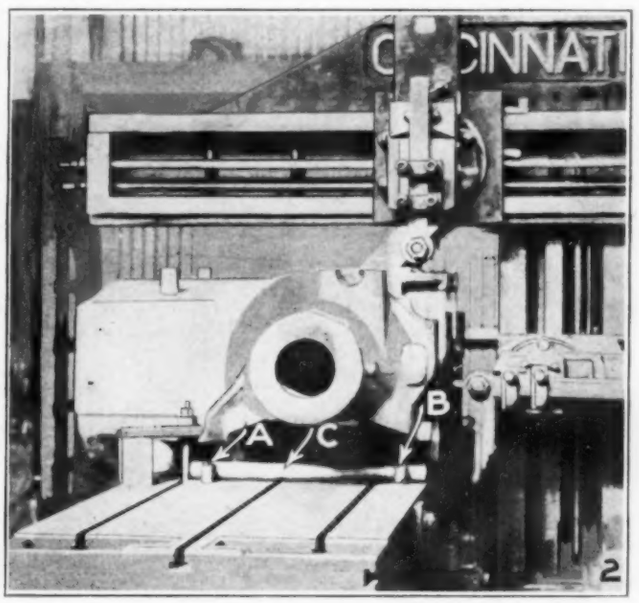


FIG. 2. ANOTHER PLANER OPERATION ON HOUSINGS

AUTOMOTIVE CONSTRUCTION

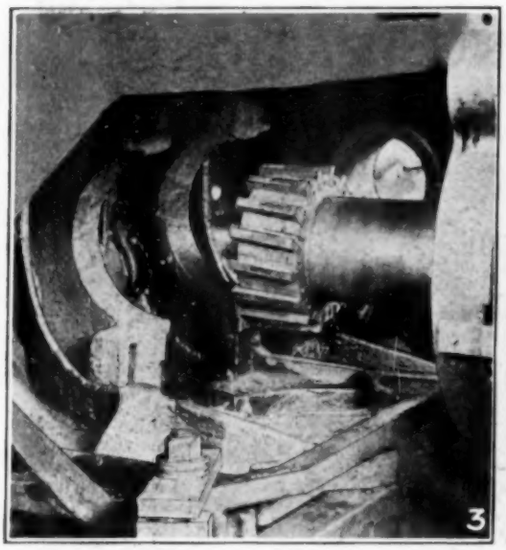


FIG. 3. MILLING THE FACES OF BEARING SEATS

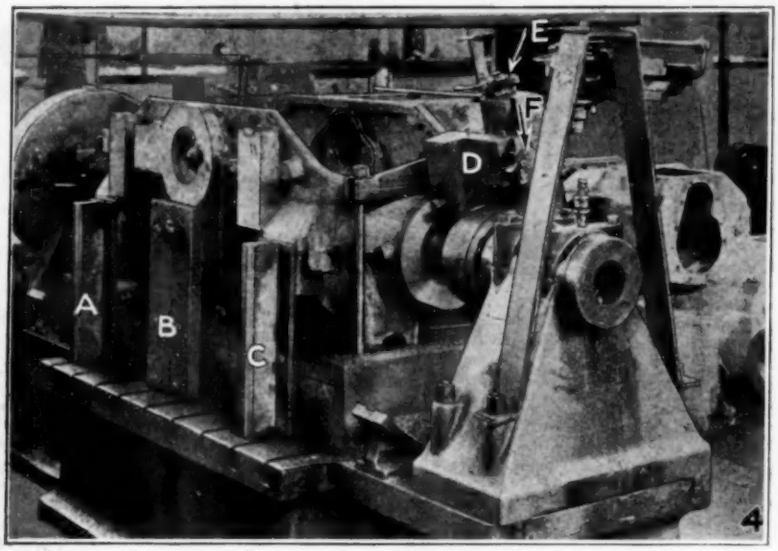


FIG. 4. BORING AXLE HOUSINGS FOR REAR AXLES

Three of the four heads on the planer are being used. Another planing operation, this time on an open-side planer, is shown in Fig. 2. This operation is not unusual, but the use of the stops *A* and *B* and the bar *C* as a means of locating the inclined edge of the casting, is of interest.

An operation, originally one of planing, is now being done by milling on a Beaman & Smith machine by extending the spindle so as to reach the spaces of the bearing supports, as shown in Fig. 3. This method has been found more satisfactory than planing for this job.

Boring the Housing

The boring of the main hole through the rear housing is done in the Barrett horizontal boring machine shown in Fig. 4. A substantial base is provided for mounting the casting, containing the uprights *A*, *B* and *C*, which serve to position the casting so that the alignment of the bore will match the previously planed surfaces. The outer ends are also faced at the same setting, one of the facing heads being shown at *D*. The usual star feed is provided for the facing feed at *E*, a second star-wheel *F* feeding the cross-slide for counterboring when this is necessary.

A second boring operation, that of finishing the cross-holes for the driving shaft which comes from the motor, is shown in Fig. 5. This operation is a comparatively simple one in which the casting is supported for the most part on a fixture that goes on the bed of the machine beside the regular table. The baseplate has uprights as at *A* for positioning the casting with reference to the planed surfaces. The overhanging part of the housing, which contains the transmission units, is supported by the regular table of the Giddings & Lewis boring machine on which the work is done.

Still another boring operation on the housing is shown in Fig. 6, and is being done on the same type of machine as the first milling operation shown. Here the

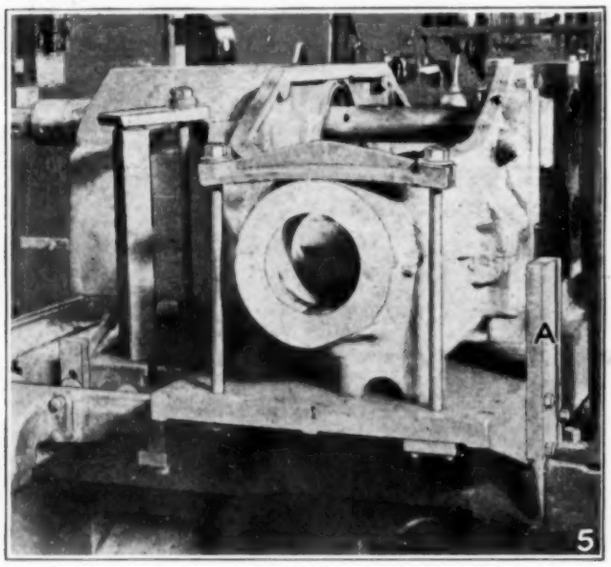


FIG. 5. BORING THE CROSS-HOLES

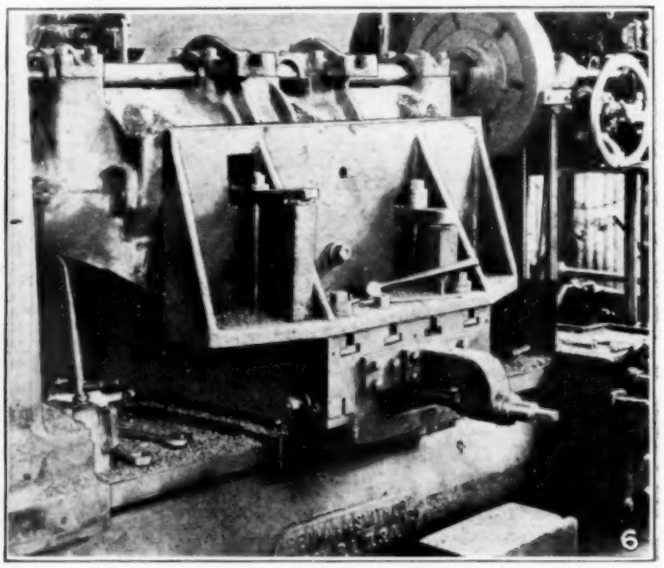


FIG. 6. ANOTHER BORING OPERATION

AUTOMOTIVE CONSTRUCTION

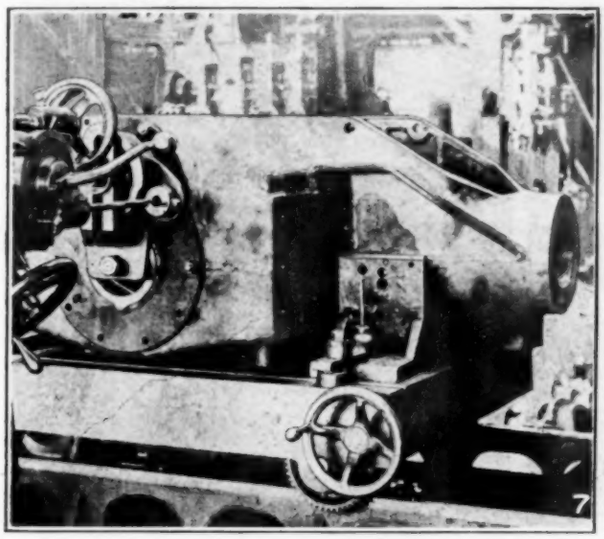


FIG. 7. DRILLING THE SIDES OF THE HOUSINGS

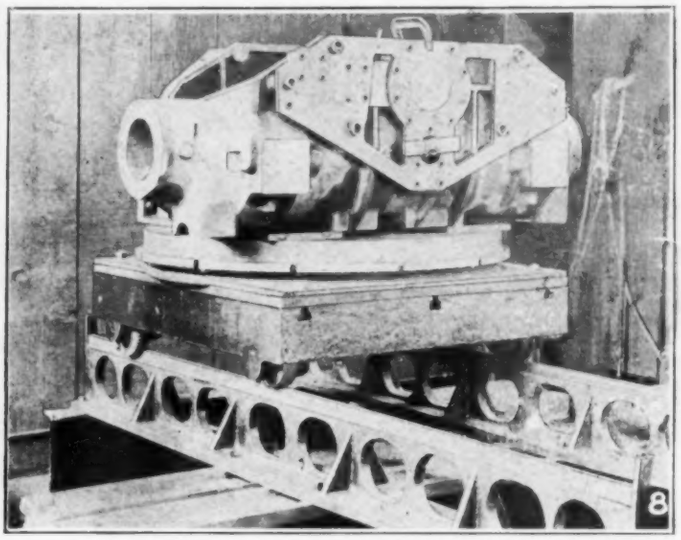


FIG. 8. DRILLING TABLE AND INDEXING FIXTURE

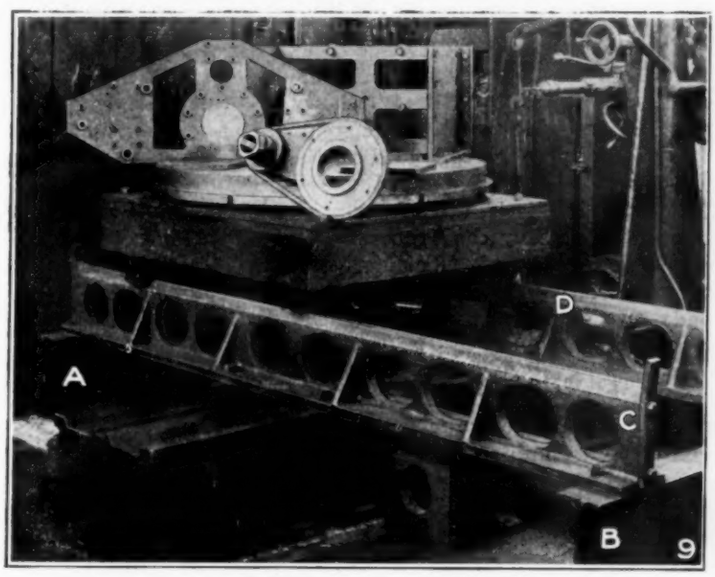


FIG. 9. THE TABLE AND FIXTURE IN DETAIL

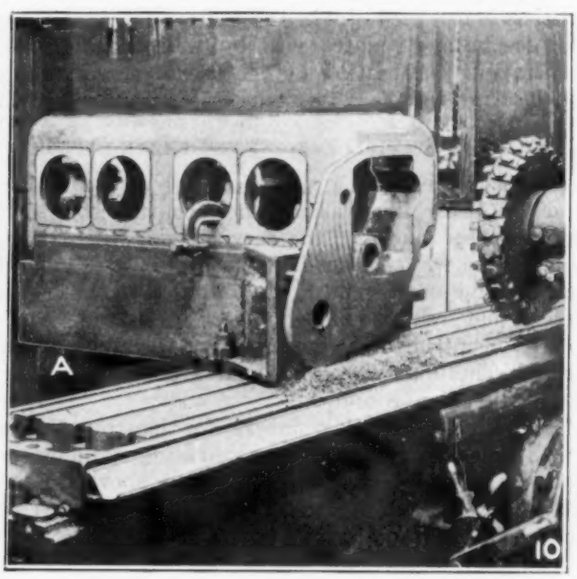


FIG. 10. MILLING END OF ENGINE BASE

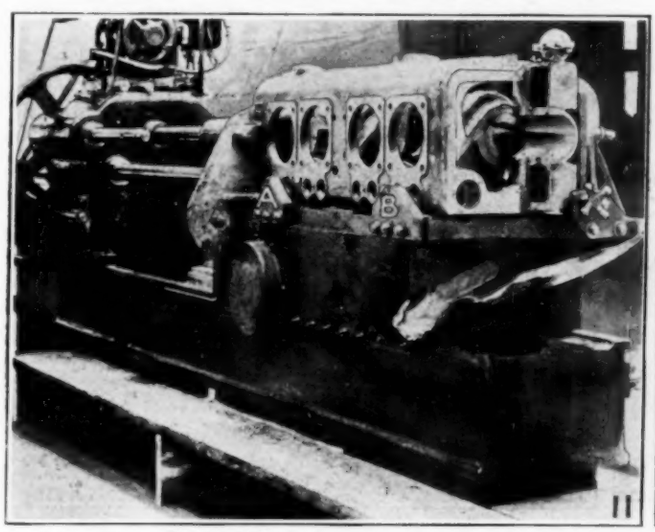


FIG. 11. BORING CRANK AND CAMSHAFT HOLES

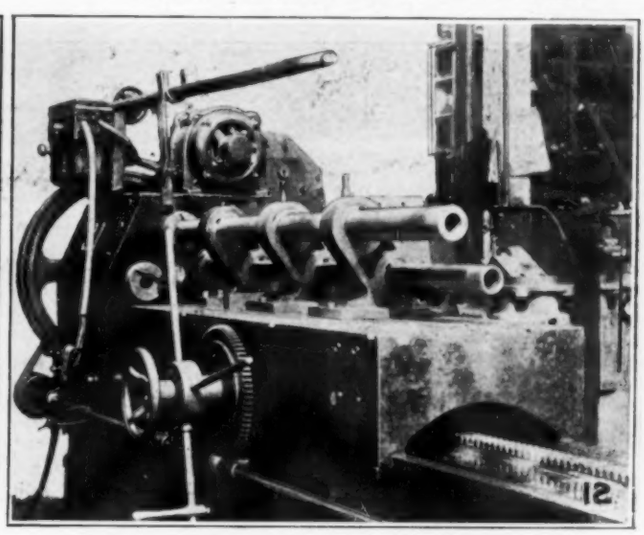


FIG. 12. DETAILS OF THE BORING FIXTURE

AUTOMOTIVE CONSTRUCTION

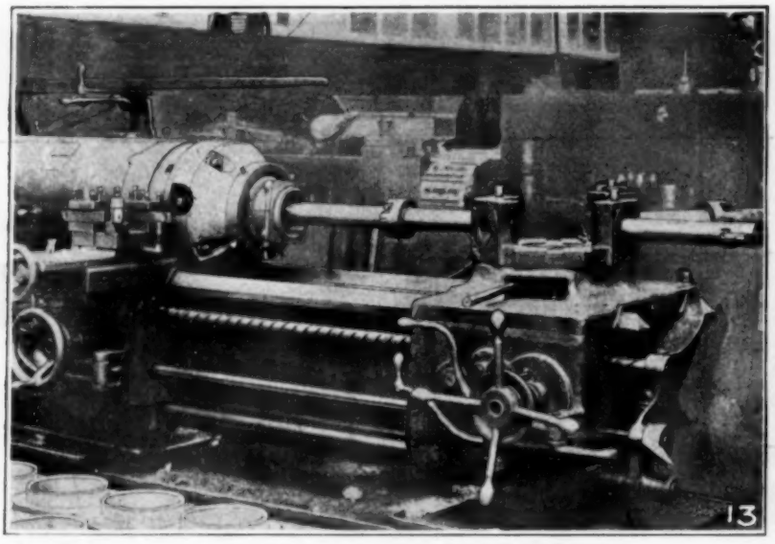


FIG. 13. BORING THE CYLINDER CASTINGS

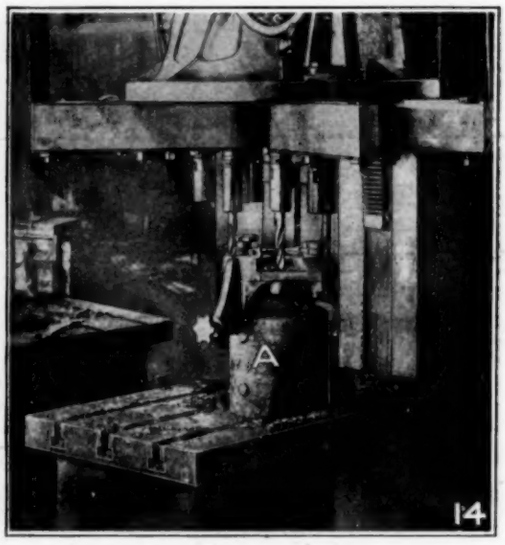


FIG. 14. DRILLING CYLINDER FLANGE HOLES

casting is mounted directly on the boring-machine table, but special angle plates, with suitable openings cut out for holding the casting by the use of straps, are used for locating the piece from the original planed surfaces.

Special Table for Drilling

Some of the drilling operations are shown in Figs. 7 and 8. These illustrations show the types of drilling fixtures used and also the carriage on which the work is mounted while being drilled. Fig. 7 shows the drilling of some of the end holes, and also shows the handwheel and reduction gear used in giving easy and positive control to the movement of the carriage on the track. This handwheel and gear are shown much more clearly in Figs. 8 and 9.

The kind of drilling fixture for locating the many small holes, so as to insure assembling without special fitting in the erecting department, is shown in Fig. 8. This view also shows the track on which the carriage is mounted, the wheels on the outer rail having a flat tread while those on the rails nearest the column are provided with coned flanges so as to insure centering and prevent derailment. It also shows very clearly that the gear is connected to the axle beside the supporting wheel, and from this view, as well as from Fig. 7, it can be seen that both wheels on that end of the carriage act as drivers. Fig. 8 also shows the turntable with the indexing notches which enable all the holes in the horizontal plane to be drilled at the one setting.

In Fig. 9 is shown the construction of the drilling machine itself, the supports *A* and *B* being for the ends of the heavy cast-iron rails *C* and *D*. These supports are I-beams of sufficient section to carry the load. The table contains a number of the drilling fixtures used, two of which have been shown in the preceding illustrations.

Motor Building Operations

Coming to the motor, Fig. 10 shows one of the interesting milling operations on an Ingersoll milling machine. The outer end of the casting is supported by a suitable rail *A* on which the fixture slides as the table carries it past the milling cutter. This fixture is simple in construction and enables the cylinder bases to be handled easily and rapidly.

The boring of the crankcase for the crankshaft bear-

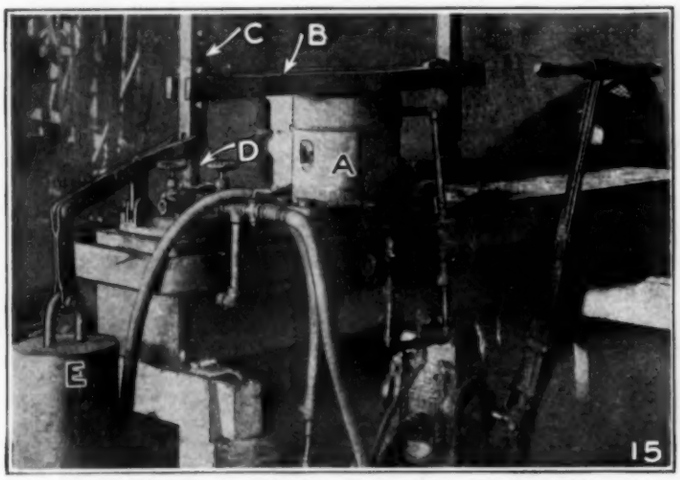


FIG. 15. TESTING CYLINDER HEADS

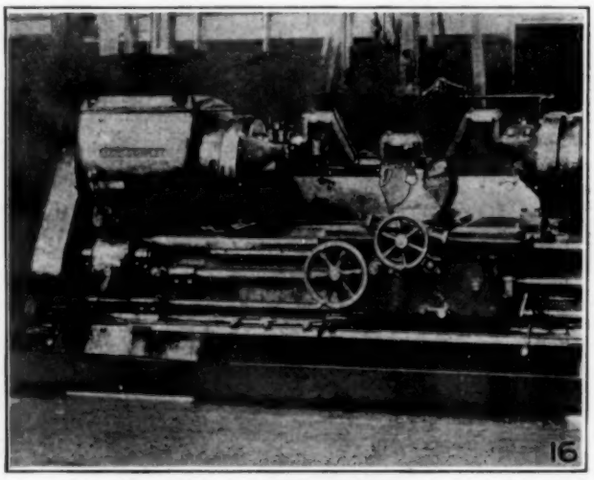


FIG. 16. DOUBLE-HEAD CRANKSHAFT LATHES

AUTOMOTIVE CONSTRUCTION

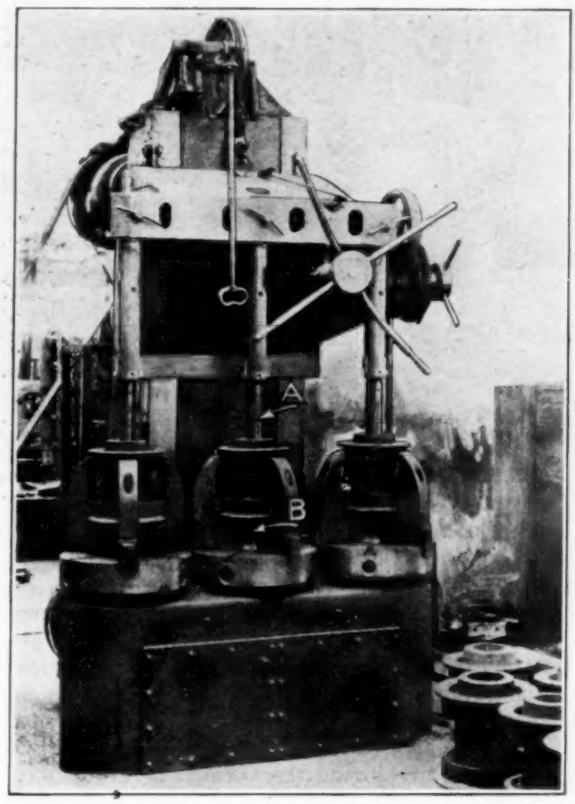


FIG. 17. SPECIAL TRIPLE BORING MILL

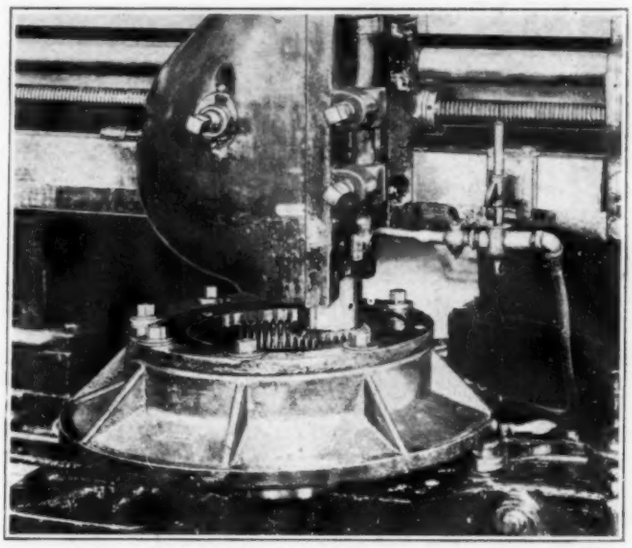


FIG. 20. CUTTING TEETH ON CLUTCH DISKS

ings is shown in Fig. 11, the machine being a special one. The type of fixture used can be readily seen, and consists principally of a baseplate with side projections *A* and *B* for locating the work from the previously planed surfaces for the bases of the cylinder flanges and the valve rod guides. The appearance of the fixture, minus the side arms which locate the casting, is shown in Fig. 12. This view shows the method of supporting the boring bars in substantial bearings inside the crankcase so as to avoid springing and to insure alignment.

The boring of the cylinder itself is shown on a Steinle lathe in Fig. 13. The form of chuck used can be clearly seen, it being a large bell-shaped casting which completely encircles the cylinder and makes it almost a part of the lathe spindle itself. The type of boring bar is also shown, as well as the tools used in the cross-slide to face the cylinder flange and turn the projection or spigot, which fits into the cylinder space.

The drilling of the bolt holes in the cylinder flange, using four spindles of a multiple-spindle drilling machine for this purpose, is shown in Fig. 14. This illustration shows the method of locating the drilling fixture by means of one of the outlets at *A*, and the clamping of the fixture to the cylinder flange by means of hand nuts and clamps.

In Fig. 15 is shown an unusual method of water-testing the cylinder heads. The head *A* is placed in position on the table resting on a suitable gasket, the lever *B* is dropped in the horizontal position shown and the arm *C* swung up into the vertical position so that the horizontal lever comes between two of the pins as shown. Pressure is then applied to a piston in a cylinder at *D*, which holds arm *C* down and holds

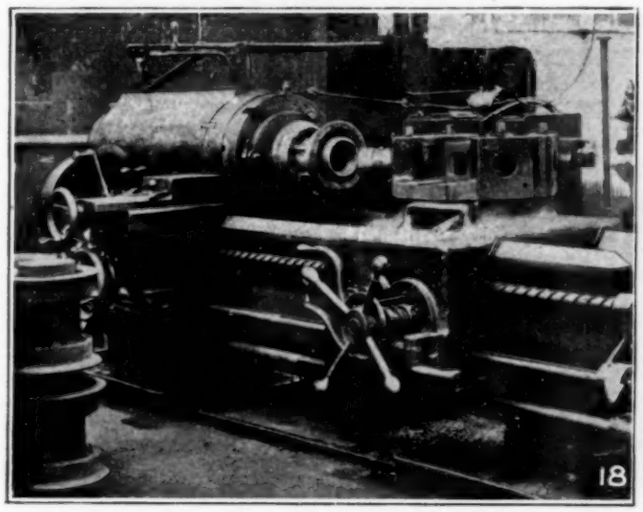


FIG. 18. FINISH-BORING TRACK ROLLERS

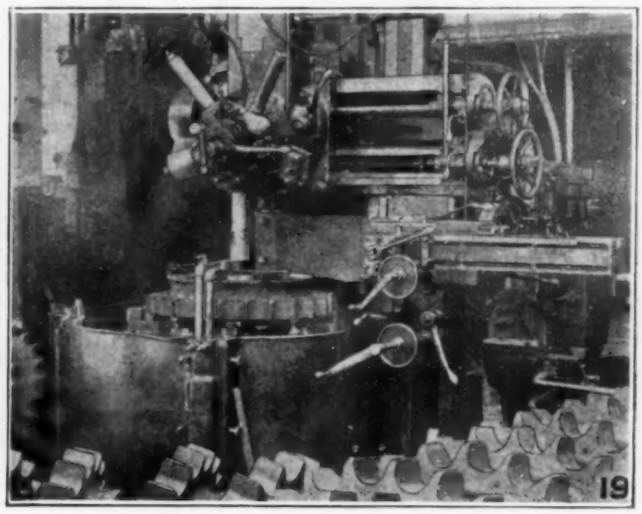


FIG. 19. MACHINING REAR SPROCKET

AUTOMOTIVE CONSTRUCTION

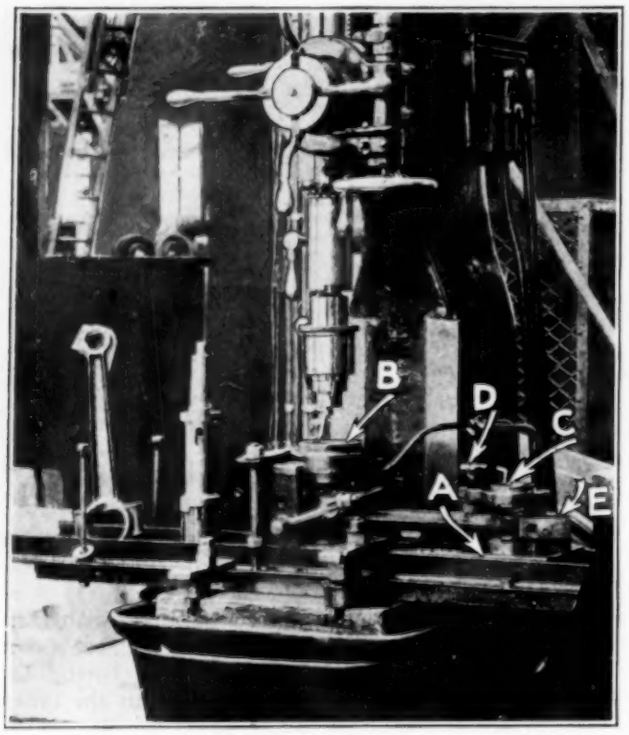


FIG. 21. FIXTURE FOR BORING CONNECTING RODS

the cylinder head firmly in place while being water-tested by means of the hand pump shown. On releasing the pressure from the top of the piston, the weight *E* lifts the arm *C*, releases the lever *B*, and the arm *C* can then be swung down to the left, the lever being raised and the cylinder head removed.

The turning of the crankshaft which is driven from both ends to avoid torsion and which indicates very clearly the general character of the equipment of the shop, is shown in Fig. 16.

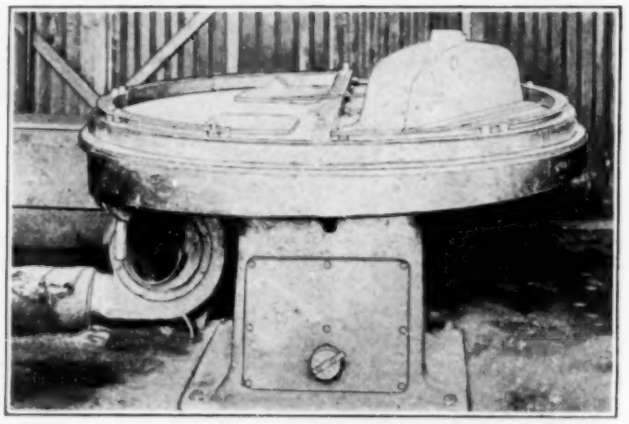


FIG. 23. HORIZONTAL SURFACE GRINDING MACHINE

Two interesting operations are shown in Figs. 17 and 18, the first being the boring of the rollers or spools on which the tractor rolls, in a special triple-head boring machine. The work spindles revolve simultaneously and the three boring bars are all connected in the same head so that they feed through at the same time. The boring bars have a pilot *A* which fits into the guide bushing at *B* in the center of the chuck, and insures a fairly accurate hole through the casting. The special chuck jaws clamp the work at both ends and hold it firmly during the boring operation.

FINISH-BORING TRACK ROLLERS

In Fig. 18 is shown the finish-boring of the track rollers on a Steinle lathe. The work is held on a special plate bolted against the chuck body, the three jaws having been removed for this purpose.

The method of boring and facing the large sprocket wheel is shown in Fig. 19, a Bullard vertical turret lathe being used for this purpose. The cutting of the teeth for the clutch disks on a Fellows gear shaper is

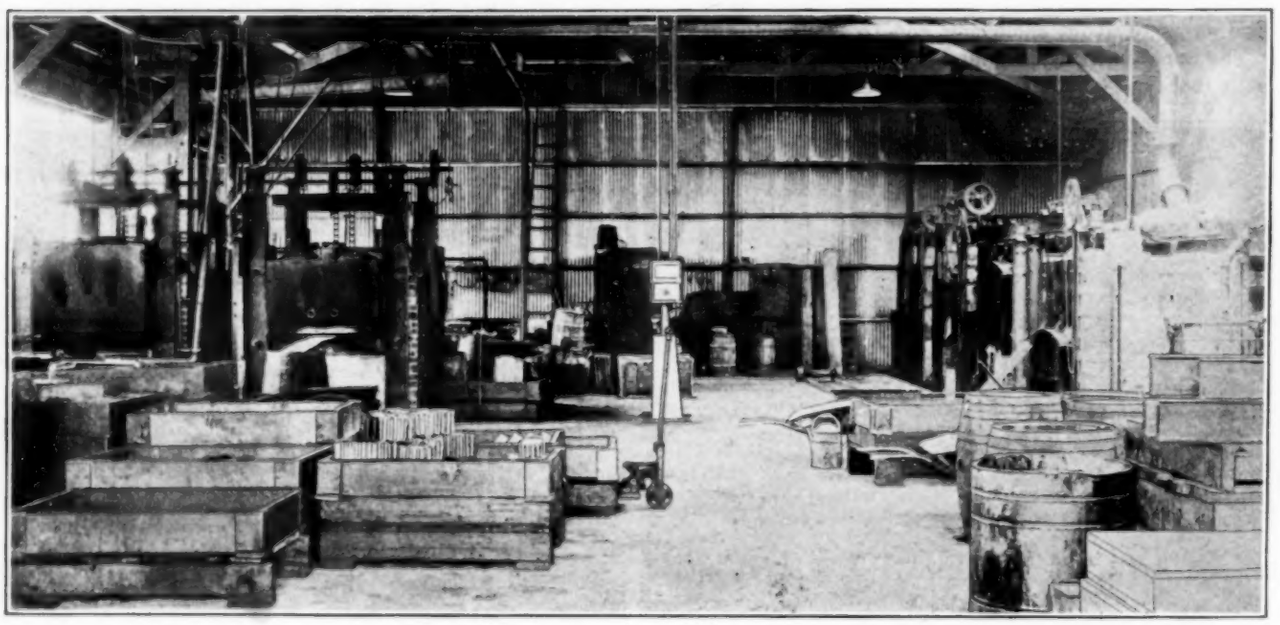


FIG. 22. THE HEAT-TREATING DEPARTMENT

AUTOMOTIVE CONSTRUCTION

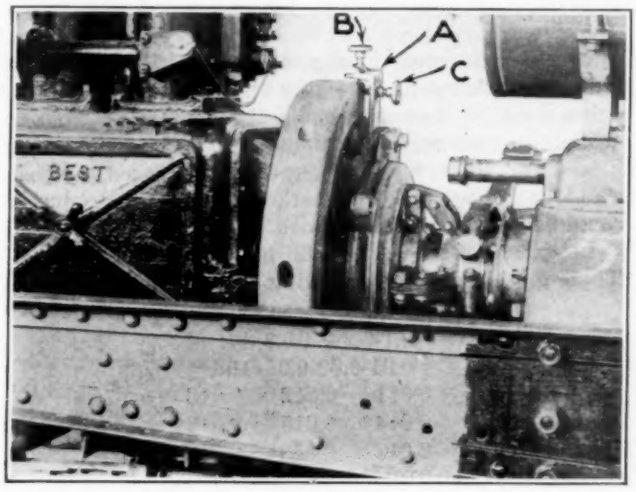


FIG. 24. ALIGNING ENGINE AND TRANSMISSION

shown in Fig. 20. A number of the clutch rings are clamped in the substantial fixture shown, and are then cut in the usual manner.

THE CONNECTING-ROD BORING FIXTURE

The fixture for boring the connecting rods is shown in Fig. 21, the boring tool for the large hole being seen in the spindle. The fixture is mounted on the track *A* and moved from one hole to the other, being indexed in the two positions. The large bushing *B* is permanently positioned on the fixture, but the small bushing *C* swings into place and is held by the hand nut *D*. The clamp *E* centers and holds the small end of the rod.

Some idea of the extent of the heat-treating carried on in this work may be had from the size and equipment of the heat-treating room shown in Fig. 22. The furnaces are oil-fired and the department is well equipped in every way for handling a large variety of work, some of it being of considerable size as can be seen from the spur pinions in the box in the foreground. This illustration incidentally shows the method of transporting work from one department to another, platforms and tote boxes together with elevating trucks being used for this purpose.

The use of the Gardner horizontal disk-grinding machine for surfacing castings of various sizes is shown in Fig. 23. Here the weight of the casting aids materially in producing the desired feed, this being especially true in the case of such castings as the engine base shown at the right. It is only necessary to press down on the work which is prevented from revolving with the disk by the cross member shown.

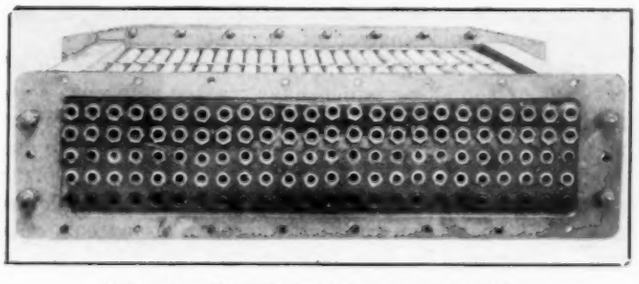


FIG. 25. DETAILS OF THE RADIATOR

When it comes to assembling the motor and the transmission in the chassis, great care is given to securing proper alignment. Fig. 24 shows the gage used for this purpose at *A*. The gage is clamped to one of the gears on the clutch drum shown, the two screws *B* and *C* adjusted with reference to the face and outside rim of the flywheel, and the transmission revolved. The gage shows instantly whether the units are in alignment or not, and also indicates in which direction adjustments, if any, are to be made.

Those who are accustomed to automobile radiators will hardly recognize the construction shown in Fig. 25. The radiator tubes all carry cooling fins on the outside, and the ends project through the plate as shown in the lower row of tubes. The annular space between the tubes and the casting is a recess for the tube packing, which is shown in place in the next two rows. A tight joint is secured by means of the packing nuts or glands shown in place in the two upper rows, these nuts compressing the packing between themselves and the bottom of the recess, and forcing it laterally against both the tube and the circular recess in the header.

A Branch Public Library at the Plant

BY FRANK H. WILLIAMS

Why not establish a branch public library at the plant?

A big percentage of employees either like to read books or would gain considerably in knowledge and ability through a greater use of books.

This is the plan that has been adopted by the Fort Wayne Edison Lamp Works at Fort Wayne, Indiana, and which has been found to be very successful. A regular circulating library has been installed under the direction of the city's main public library and operating under the same rules and regulations.

At this branch a certain number of fiction and other books are carried together with the library's complete catalog. When an employee desires a certain book, the name of the book is given to the branch librarian and the book is secured for the applicant in the shortest possible length of time. The employees appreciate the plan immensely and many of them avail themselves of the scheme.

The branch library was installed at the Fort Wayne Edison Lamp Works by the effort of E. D. Moeller, who is in charge of welfare work at the institution.

Perhaps there is a suggestion in this for the welfare managers of other large plants.

Know Why You Do Things

BY L. S. WATSON

On page 612 of *American Machinist* I read Mr. Forbes' article about "Knowing Why You Do Things."

I always supposed that it was proper to place the tool on center for certain jobs and above center for other jobs, but have never heard of putting a tool below center. I have read Mr. Forbes' previous articles with interest and hope soon to learn his reasons for placing a tool below center.

Precision Gages

By M. E. KANEK

Methods of accurate measurement, as well as precision gages themselves, are comprehensively treated in this article. Regarding gages, the shape, size and material are all given consideration. The use and scope of the measuring machine and the method of comparison by light interference are discussed.

WHEN America entered the war there was at once thrown upon American metal workers a far heavier burden than is realized even now by the non-mechanical public and by a large portion of the mechanics of the country.

Many of the products demanded were extremely complicated, and in order that they function properly it was imperative that each component be accurate to exceptionally close limits. In many cases it was impracticable to manufacture complete mechanisms in a single plant, and occasionally units from three or four plants were collected at an assembly station to be assembled for shipment as a completed product. Obviously these units must be "interchangeable" in the most perfect sense of the word. Even though the drawings from which the products were made "checked" perfectly it was possible, for instance, for a hole made 0.5005 in. in one shop to be too small for a pin made 0.500 in. in another shop. The micrometers in one place may be adjusted to one standard while those in another shop may be noticeably different, being adjusted to another standard.

This possibility became apparent several years ago to a Swedish inventor, who developed a combination of different sizes of solid gages which were finished to a hitherto unapproached accuracy. With a set of precision gages which could be depended upon for accuracy and which were known to be identical with those in other plants, there could be little possibility of trouble in assembling parts which were made to correspond to the precision gages.

Gage Block Sets

The first sets of precision gage blocks to come to America were made up of the now familiar eighty-one sizes. There are really four sets in one. The first set of four gages, in 1-in. units, gives any even inch from 1 to 10 in. The second set of nineteen gages, in 0.05 in. units between 0.05 and 0.95 in., gives any even multiple of 0.05 in. between 0.05 and 10 in. when used in connection with the even-inch series. The third set of forty-nine gages, in 0.001 in. units between 0.1 and 0.149 in., can be used with the other two to get any even thousandth within the range. And the fourth set, composed of nine gages varying by 0.0001 in., may be assembled with the others to get any ten-thousandth in. between 0.2 and approximately 10 in. The large number of gages in the third set (49) is, of course, due to the dimension of the smallest gage in the set, which is 0.05 in. In order to secure the intermediate sizes there must be individual gages as there are none which are thin enough to be built up to form them.

For some reason not apparent American manufacturers have adopted these same sizes and prepared the same 81-block sets. Obviously the cost and the selling price must be dependent upon the amount of time required in making. If the number of gages could be halved and the range unchanged or increased the price could be halved and the market enlarged. Production could be greatly increased with the same equipment.

Let us suppose a set of 30 gages instead of the 81. These might be in the following sizes:

1.-2.-3.-4
0.1-0.2-0.4-0.8
0.01-0.02-0.04-0.08

0.011	0.012	0.013
0.014	0.015	0.016
0.017	0.018	0.019
0.0101	0.0102	0.0103
0.0104	0.0105	0.0106
0.0107	0.0108	0.0109

With these thirty sizes any ten-thousandth between 0.02 and 10 in., or more, can be built up. This set can be made for half the cost of the 81-block set, and has a range of several hundred more sizes. It provides ten-thousandths between 0.2 and 0.02, which the 81-block set will not do, with nine exceptions. The writer has heard more than one toolmaker express wonder that our gage makers have not developed a much smaller set than is available. Who will be the first? It is a safe wager that the firm which starts the reduction in numbers will have the entire field following at its heels.

Types of Precision Gages

There are several types or shapes of precision gages on the market today, but only three are used to any extent. These are the sphere, as exemplified by the steel ball; the cylinder, as seen in the plug gage; and the two planes, parallel and accurately separated, as exemplified in the solid "size blocks."

The ball is of little value because of its limited possibility of application. It is also practically impossible to manufacture a sphere to the degree of precision desired, and, still further, there is the extremely short life of the ball. The area of contact between a sphere and a plane surface is, of course, so small as to concentrate the wear and to tend to produce a flat surface on the ball each time it is used. In a short time the accuracy of the ball, and hence its value as a reference standard, is gone.

In the case of the plug, or cylinder, the objections are not as well founded as with the ball, because the contact is a line instead of a point. There is the same difficulty of manufacture, only in a lesser degree. It seems that plug gages will serve their greatest purpose in the inspection of holes instead of as masters.

The blocks having two parallel planes, as used in 90 per cent of the shops which have master reference sets, present one of the prettiest problems which has been put up to the gage maker. It is a simple matter to make one surface flat, but when there is required another plane surface not only parallel to the first but a pre-determined distance from the first there arises a real problem. It can only be done between two laps which are, in turn, held parallel and the desired distance apart. And,

if the laps are in a horizontal position and the weight of the top lap is appreciable, it will probably be found that the surface characteristics include a "running" off at the edges. The writer has made some experiments along this line and has found that the flatness of the surface can be improved by light rubbing on a very slightly convex hand lap after the gage comes from the machine.

The flat surface, then, may be accepted as offering the greatest value. Such gages are made with various sections. Some are round, some oblong, some a full square and still others a hollow square.

Effect of Size on Accuracy

All have their peculiarities, and curiously enough the peculiarities and inaccuracies seem to be governed by size rather than by shape. For instance, take the familiar oblong gage. The writer measured many of them, and in nearly all cases the gages marked a certain dimension have been found to show the same error, although of different shapes or from different makers. Three-inch gages run long. Some of them are as much as 0.00009 oversize, and 80 per cent of them are from 0.00005 to 0.00007 long. Two- and four-inch gages usually show about 0.000015 and 0.00004 oversize respectively. One-inch gages run nearly correct, but those just under this size seem to run long. This is true of all makes in so far as they have at present been investigated.

It would appear from the above that there is still room for development in the case of the longer sizes. The square gage with a hole at the intersection of the two diagonals seems to have one or two good points not possessed by the others. The hole permits more free circulation of the quenching medium in heat treatment, which may tend toward more uniform structure. The hole also permits facile clamping into stacks. It does not insure however, the absolute alignment which is imperative when the gages are used in connection with the "half-plug" attachments which are provided for measuring holes. If the axes of these two plugs, which are at opposite ends of the stack, are not parallel the accuracy of the stack is destroyed and the setting is of little value. Some shops have made a channel which just permits the gages to enter, for use in assembling stacks with attachments. With this trough, or channel, a very satisfactory setting may be made.

Material for Gages

In making up stacks for use the maker's marking is perforce depended upon for the size of the stack. If any one gage has become worn from use the stack may be small. If the gages have "grown" as a result of incomplete "aging" the stack will be large. And so the selection of material is important for several reasons. First, it must have high wear-resisting qualities; second, it must be susceptible to accelerated seasoning or aging processes; third, it must in its hardened state have high rust-resisting qualities. In view of the fact that all makers of gages in the "precision" category have settled upon an alloy having 1.35 per cent chromium and 1.0 per cent carbon it seems probable that this material offers the nearest ideal raw material. The treatment varies greatly, however. Gages may be found which show only 80 on a scleroscope, while others show 97. The writer has seen gages considerably large, although they had at one time been correct, with a scleroscope reading of 82; and he has seen one gage which showed 96 scleroscope and which had not changed in size over a period of fifteen months. From this it would appear that the aging process seems to affect hard gages more permanently than the softer ones.

The alloy of 1.25 to 1.50 per cent chromium with about 1.00 per cent carbon gives excellent results as to hardness, wear-resisting qualities and rust resistance. It also shows permanence of size and shape when properly normalized and hardened, provided the strains are relieved after hardening by a series of "draws" at varying temperatures. Some makers use a low carbon steel for gages and harden after carbonizing to shallow depths. Results are often satisfactory when the gages are symmetrical in shape.

In a cube or sphere or cylinder there will be little change in shape when properly treated, while with thin flat gages there will be found after a very few days a noticeable convexity on the sides of largest area.

Assembling Gage Blocks

The assembly of sets or combinations is far too little understood. They are usually "wrung" together, and it is commonly supposed that gages which will wring are perfectly flat, and their accuracy is frequently taken for granted. As a matter of fact a lapped surface of the commonest size in use (9 x 30 mm.) may be as much as 0.000015 in. concave or convex and still wring to another one 0.00001 in. in error in the same form, i.e., both convex or both concave. The mere fact that two surfaces may be made to wring together does not prove that they are flat.

Gages which are to be built up into a combination for checking other gages should be carefully cleaned. The hand, or cloth, or waste, should not be used. They should be washed on the lapped surfaces by lightly drawing them across a piece of paper toweling on which has been poured a few drops of naphtha, benzol or grain alcohol, and then at once drawn for an inch or so over a clean, dry piece of the same material. Newspaper and cotton batting are usable substitutes but are not as good as toweling fresh from the carton or roll.

After the gages have been washed a warm breath should be blown on the two surfaces to be wrung together, and a slight sliding motion given them. As the motion alternately covers and exposes the surfaces the thin film of moisture evaporates and the gages will suddenly "seize," just as though stuck together. They are now "wrung" and may be depended upon to be within 0.000003 in. of actual contact. In many cases they will be much closer, but if more than that they will not seize when properly cleaned. Alcohol instead of the breath will also cause them to wring closely, but is not recommended because of a tendency to cause a discoloration much like rust.

Handling Gages in "Stack"

After a number of gages have been wrung together to form a "stack" they should be left on a surface plate or other iron or steel plate for at least ten minutes in order to allow the temperature to return to normal, or approximately so. They will grow larger while handling, about 0.000006 in. per in. per degree rise in temperature, and if three or four are wrung the change will often be several degrees. In some shops all precision gages are handled only with gloves.

The manufacture of gages of this kind is not entirely a manufacturing problem. One of equal interest is the

measuring in such minute quantities as 0.00001 and less. There are, briefly, only two methods of measurement. The most common is that of direct reading from a scale, screw, rack, lever, or wedge. The other, by comparison of work with a reference gage of known size. In speaking of them they will be called "direct" or "original" and "comparative" methods.

Accuracy of Instruments and Skill of Operator

The success or reliability of the direct method depends upon two elements—the accuracy of the measuring engine and the skill of the operator. With some of the better known types of measuring machine it is possible for an expert operator to determine a dimension with as small an error as 0.00001, or, in other words, he can repeat his observation within 0.00002.

When a measuring machine is being used continuously there are many changes taking place. The body temperature of the operator, who necessarily stands in close proximity to the machine, has a more or less marked effect on the machine itself. The temperature changes in the machine are greater on the side near the operator, and of course the elongation of that side due to the higher temperature throws the headstock or measuring head out of alignment with the footstock. Most of these machines depend upon a "drop plug" held between two flat faces for a telltale device. Unless the plug is perfectly cylindrical and the two retaining faces plane and parallel, conditions are not identical through a series of measurements. Obviously the results will not be reliable. The contacting anvils must be plane and parallel, a condition rather difficult to obtain when temperature changes are disturbing alignment; the screw error must be constant throughout its length if the compensator is to correct it properly; and all oil films in the operating portion of the machine must be of constant thickness. The graduations on the dial or scale must be correct and the observer must be highly skilled.

The "Comparative" Method

There remains the "comparative" method of measuring. All of the makers of precision gages are using some method of comparison for their final calibrations. This is proved by the uniform error in gages of the same ostensible size. Among the most common devices of mechanical nature are the dial indicator, the fluid gage, and the various indicators which employ the lever, either simple or compound. Any of these will show a half thousandth, and at least one is graduated to show ten-thousandths, or less by estimation. In none of them is there the rigidity needed for measurements to 0.00001 in. or less.

Still another plan, and perhaps the most accurate of all, employs a phenomenon discovered by Newton in the seventeenth century, the "Newton Rings." These rings are alternate bands of different spectral colors which become apparent to the eye when a transparent surface is brought within 0.0002 in. (approximately) of another surface of the same shape. These bands are due to the interference of light waves and when the two surfaces are plane the bands are uniformly straight and parallel. If one of the surfaces is plane the bands will indicate with precision the shape of the other surface.

In employing this method the only equipment necessary is a plane surface to which the reference gage and the work may be wrung, and a transparent plane. The two gages are placed side by side on the plane, and the rings or bands are produced by the transparent plane. Any difference in size becomes at once apparent by the irregularity of the bands across the two surfaces of the gages.

The fact that two gages are exactly the same size may be determined in a very short time by this method, but the accuracy of a quantitative measurement of the difference between two which are not alike may perhaps be questioned, unless a light from a source which has a known wave length is employed. Inasmuch as scientists do not agree on the wave-length measurements of various lights there is much research to be made before the optical or interference-fringe method will be of great value, except for actually identical gages. A peculiar sidelight on the above comes from the fact that purely monochromatic light is a rara avis. And, when two or more colors are combined in a light ray there are varying wave lengths in the same ray.

The objections to this method of measuring are: The difficulty of securing contact between the gages and the base plane; the practice necessary to enable the proper interpretation of the fringes or bands; the difficulty of securing transparent planes; and the inaccurate knowledge of the wave length of the light ray used. The writer has made many comparisons by this method and, while it is possible to repeat a measurement within 0.000005 in. (half a hundred thousandth), it is safe to say that figures purporting to be closer than that are largely guess work.

For ordinary work the measuring machine may be relied upon for original measurements to 0.00003. For accuracy from 0.00002 to 0.00003 in. the amplifying gage or indicator may be used. For measurements to 0.000005 in. the optical or interference-fringe plan seems to offer the only solution.

France Rapidly Developing "White Coal" Resources

Development of her water power under plans now being carried out will make France third among the nations who lead in this respect.

The report of the Commission des Forces Hydraulique shows that in round figures the water power (colloquially known as "white coal") in France may be reckened theoretically at about 9,000,000 horsepower. Of this amount 1,165,000 hp. is in use and about 500,000 hp. additional is being equipped.

In about fifteen years 6,000,000 hp. more should be realized. The rest remains available for eventual development. The 1,165,000 hp. now installed is capable of 850,000 kilowatts. In 1919 it furnished effectively 700,000 hp. (570,000 kw.). The plants in course of construction provide an additional 550,000 hp. (365,000 kw.).

The region of the southeast of France is the best developed thus far, with 750,000 hp. already installed, and with 290,000 hp. in the course of installation. The southwest has 210,000 hp. and will have 75,000 more in a short time. The central section has 140,000 hp. and is making plans for an additional 125,000 hp. The eastern district expects to increase its 25,000 to 35,000.

Existing plans are to provide the 3,000,000 hp. additional of the program inside the fifteen years. Of this total 1,200,000 hp. will be in the southeast, 500,000 in the southwest, 40,000 in the center and 62,000 in the east.

The Design of Square and Acme Thread Taps of Steep Lead

By E. A. DIXIE

The quicker the lead of a thread, the greater is the necessity for fluting the tap so that the cutting faces will be at an angle of 90 deg. to the helix angle of the thread. Otherwise one side of the cutting face will present an obtuse angle.

IN FIG. 1 is shown a set of four taps ½ in. pitch and 1 in. lead by 1 in. outside diameter, that were intended to tap a thread in the machine steel piece *A*, which in the illustration is shown cut in half after No. 1 tap stuck in it so tight that the square was twisted off the shank. This tap broke when it had been entered about one inch.

A glance at the illustration will show what was the matter. One side of the thread had a sharp cutting edge at an acute angle while the other side was at an angle of about 110 to 115 deg. and tore instead of cut the metal. With this class of tap the flutes should always be helical so that both edges of the thread have the same cutting clearance. Even with helical flutes it is difficult to cut clean threads with the acme or square shape of thread unless one makes the leading tap start with some variation of the V-thread and gradually change to the form desired, be it acme or square.

In Fig. 2 is shown what is meant. At *A* the tap is started with a V or U.S.S. thread, narrow in width and shallow in depth but gradually deepening and widening till the predetermined point *B* is reached. The square thread can begin at *B* either as a shallow thread which gradually deepens toward *C* or if the V-thread has been cut to full depth it can start as a narrow thread of full depth at *B* and gradually widen as it approaches *C* or it can start as a narrow and shallow thread at *B* and gradually both widen and deepen as it approaches *C*. I have seen satisfactory taps made in all three ways.

There are at least two ways in which the lathe can be set up for cutting the thread on this kind of a tap. Change gears in some cases may be available to produce

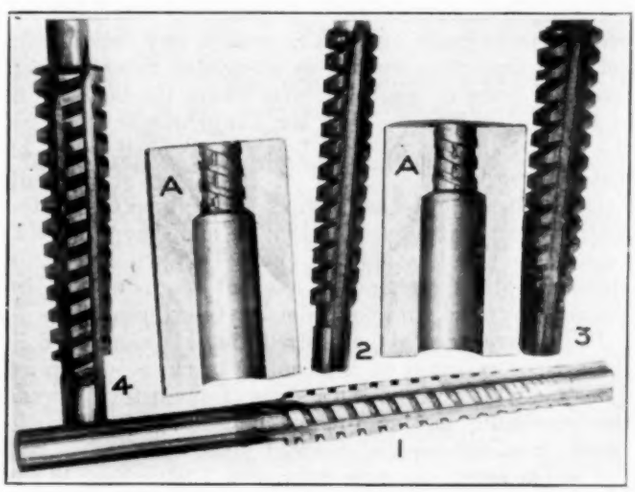


FIG. 1. SET OF IMPROPERLY MADE ACME THREAD TAPS AND THE WORK

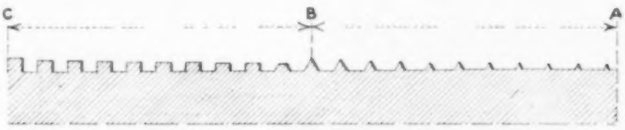


FIG. 2
Square Thread Tap with V Thread Leader

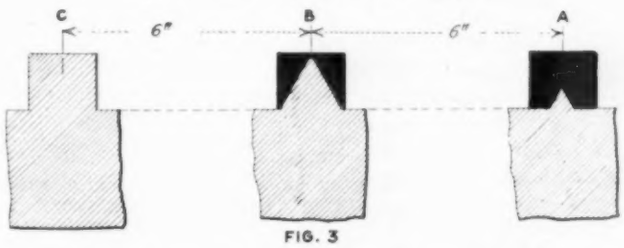


FIG. 3

FIG. 2. DIAGRAM OF SQUARE THREAD TAP WITH V-THREAD LEADER. FIG. 3. DIAGRAM SHOWING CHANGE OF FORM AND STOCK REMOVED

the gradual change in the width of the base of the V-thread or a combination of the taper attachment and the set over on the tailstock used to produce the same result. The change in shape on the square or acme shape of thread can be best obtained with either the taper attachment alone for the acme shape of thread or a combination of the taper attachment and the tailstock set over for the square thread.

When making taps of this type the writer has been accustomed to thread them at the start just as though they were ordinary square or acme taps. Where they were in sets, as those shown in Fig. 1, all the taps of the set were first made with either the square or acme form of thread from end to end. It was then decided just what length V or U.S.S. thread should be required for the leader. Let us assume that there are a certain even number of threads in a certain length, as for instance 12 in. as shown between *A* and *C* in Fig. 3, and that we have decided to make the V-threaded leader 6 in. long from its start as a very small thread at *A* till it reaches full size as shown at *B*. The black portions at *A* and *B* show the amount of metal that has to be removed from the original square threaded No. 1 tap. Obviously if we left the setting of the work parallel with the ways of the lathe and used the same change gearing we would cut the same shape and size of thread on *B* as we start to cut on *A*. But we want a wider and deeper thread at *B* than we want at *A* and the only way to obtain it is by changing the lead which the lathe is to cut so that we may be able to start a cut in the middle of thread *A* and gradually recede toward the right way from the center of the thread which has already been cut until when we reach the thread *B* we have receded so much from the center of the thread that one-half of a large V-thread occupies the space between the threading tool and the center thread *B*. This change in lead can be readily obtained either by correct change gears, if we have them, or by setting over both the tailstock and the taper attachment or by a combination of both. This phase of thread cutting has been covered so often in the pages of the *American*

Machinist and is so well understood that it is not necessary to repeat.

The diagram, Fig. 4, shows the gradually decreasing cut of the tool *X* as it advances from the starting thread *A* and approaches the thread *B* which is the termination

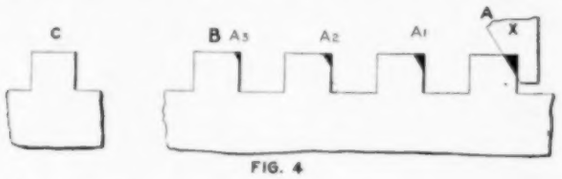


FIG. 4

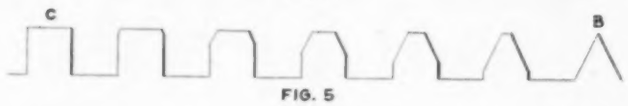


FIG. 5

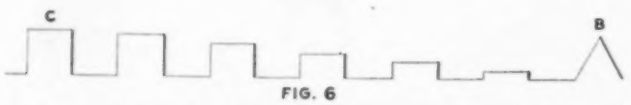


FIG. 6

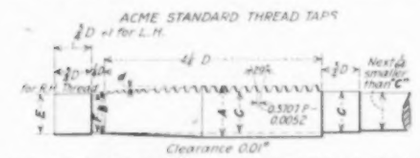
FIG. 4. SHOWING METHOD OF REMOVING STOCK FROM THE SQUARE THREAD TO TRANSFORM IT INTO A V-THREAD. FIGS. 5 AND 6. TRANSFORMATIONS FROM V-FORM OF THREAD TO SQUARE FORM OF THE FINAL TAP

of the V-threaded portion of the tap. After both sides of the square thread from *A* to *B* have been turned to the desired V, that part of the tap can be considered finished as far as threading is concerned.

The square or acme portion of the thread can then be formed beginning at the next thread beyond *B* either to the shape shown in Fig. 5, where the same method and tool is used as in Fig. 3 with the results that the V-shape of thread at *B*, Fig. 3, is gradually widened until it becomes either a perfect square or acme thread; or a square-nosed tool can be used as in Fig. 6 and the taper attachment used so that the square or acme shape of thread starts at the thread beyond *B*, Fig. 3, as a very shallow thread and gradually grows deeper from thread to thread until the full depth is reached a few threads before the end of the last thread on the final tap is reached.

It is a matter of individual taste which of these methods is preferable; to the writer's mind one is just as good as the other. In either case the full depth and width of thread left by the V-portion of the tap when run into the work will afford considerable chip space over and above that provided for by the flutes of the tap.

In Fig. 7 are given the details for making Acme standard taps. It will be noted that a variation of the method just described is used for forming the leaders of these taps. For single thread taps this method is all right but for multiple threads the other is better.



Tang of Angle of Lead = $\frac{.4647}{D-\frac{1}{2}P\times 1.54}$
D = Diam. of Screw
P = Pitch = No. of Threads per Inch
H = Diam. of Tap Drill = D - P

Nick teeth of first tap as shown, making nicks $\frac{1}{64}$" deep and approximately 0.25 pitch wide, disappearing on last tooth of taper. Use for nicking U. S. Standard Thread Tool.

	A	B	C	Tangent a Use same taper from diam. F to diameter C	E	F
1st Tap	$D-(\frac{1}{8}P-0.0075)$	$D-(\frac{1}{8}P-0.005)$ or $H-0.005$	$D-(P+0.04)$	$\frac{P+0.035}{20.8}$ or $\frac{A_1-D}{19.5}$	$D-(P+0.002)$	$D-(P+0.04)$
2nd Tap	$D-(\frac{1}{8}P-0.0125)$	$D-(\frac{1}{8}P-0.0075)$ or $A_1-0.005$	" "	" "	" "	" "
3rd Tap	$D-(\frac{1}{8}P-0.0175)$	$D-(\frac{1}{8}P-0.0075)$ or $A_2-0.005$	" "	" "	" "	" "
4th Tap	$D+0.002$	$D-(\frac{1}{8}P-0.0025)$ or $A_3-0.005$	$D-(P+0.002)$	" "	" "	" "

FIG. 7. TABLE OF DIMENSIONS OF ACME STANDARD TAPS

A Comparative Test for High-Speed Steels

BY FRANK A. HURST,
Works Manager, Samuel Osborn & Co., Sheffield, England

I have read with considerable interest the four articles under the above title by H. J. Langhammer which appeared in Vol. 52, pages 979, 1140, 1227 and 1292 of the *American Machinst.* There are, however, a few points which, from one connected with a firm that has been testing tungsten tool steels for the last 50 years, may be of interest to your readers.

I quite appreciate the fact that for tests, as carried out by Mr. Langhammer, there must be standard conditions, but experience has shown the manufacturer of high-speed steel that in his testing there must be one very large variable, namely the material upon which the steel is tested. All Mr. Langhammer's tests were carried out on the same kind of material, whereas, in manufacturing tool steel for the general trade it is necessary to select, not the particular composition that will give the best results on one material only, but one that will give the best all around results on the various materials used in every machine shop.

My experience at the works with which I am connected (maker of Mushet tool steel) is that in order to produce a steel that will give the greatest general satisfaction, it is necessary in deciding on the formula for the mixture, to make cutting tests on steels having a carbon content of 0.30, 0.60 and 0.90 per cent. Also on both hard and soft cast iron.

My decision as to the composition of the steel to supply to the general public has always been for that composition producing a steel that will give the best general all-around results on the above mentioned five different materials.

From this you will see that it is quite possible for the adoption of Mr. Langhammer's system to cause the user not to select the best steel for his purposes, but one that is the best for only one variety of material.

Few manufacturers buy more than one grade of high-speed steel for work on different materials, but make tools from the same bar for cutting all kinds of steel and cast iron, therefore, the force of the above remarks will be apparent.

After careful examination of the analysis given by Mr. Langhammer as ideal, I would remark that providing some of the steels which he considers inferior have been properly made, there is no reason why they should not give first-class results as all-around machine-shop steels. I know of machine shops where the business is of such a class that the steel Mr. Langhammer considers the best, would not give the best results on the kind of material worked.

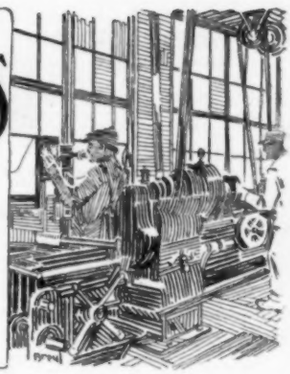
In testing tools I have always found it necessary for getting comparative results that in addition to careful grinding, all tools should be finished off with an India oilstone. Mr. Langhammer has not done this and its omission has had a marked effect on the results.

Further regarding the desired analysis mentioned in the articles referred to, the content of chromium stated gives too wide a range and its use in quantities between the maximum and minimum content specified would result in a different high-speed steel.

I would again say how interested I have been in the articles and how much Mr. Langhammer is to be congratulated on the carrying out of his tests.

MODERN PRODUCTION METHODS

By
W P. Basset
of
Miller, Franklin, Basset & Co



WE SAW in the preceding article how current expenditures were started on their way into the finished product through the charge register. There are other charges which make up part of the cost of the product but which are paid either in lump sums or do not entail any cash expenditure whatever. They are the fixed charges, so called because they do not fluctuate appreciably with the activity of the plant.

Taxes and insurance are paid usually once a year, although sometimes only once in two or three years, and yet each unit of output must bear its proper share of these expenses. Depreciation on buildings and equipment is solely a book entry and yet a part of it must be gotten back in the selling price of the product in order that sooner or later the existing buildings and equipment may be replaced. All of these fixed charges are first charged to the various departments of the plant and from there into the product which passes through each department. In a later article we shall describe the principles which underlie the proper departmentalizing of the plant. It is simply mentioned here in passing so that it may be definitely understood that the plant *is* divided into departments.

XII. Fixed Charges

What to do with fixed charges has been a perplexing question for many a shop executive. Here the author tells what expenses constitute fixed charges and explains how to allot to each department its fair share of the total.

(Part XI appeared in the Oct. 28 issue.)

Taxes and insurance admittedly fluctuate somewhat from year to year, but sufficient accuracy can be obtained by carrying into the costs a figure based upon the amount of these two items for previous years. A charge is therefore made to each department on a monthly basis.

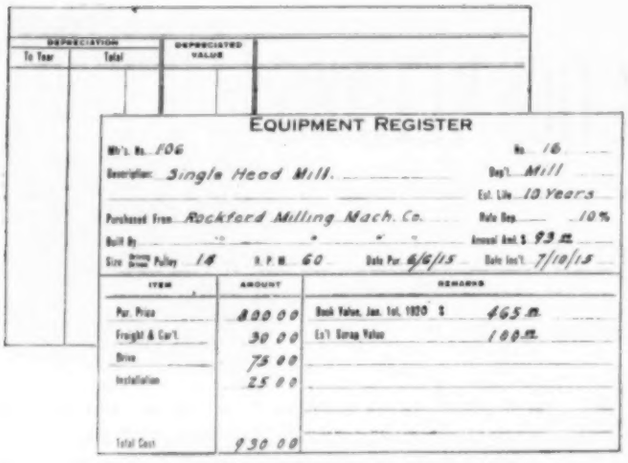
Serious errors may creep into the final costs of the product through incorrect charging of depreciation. It is not uncommon to find concerns which split hairs in an attempt to get labor and material charges correctly apportioned to the various types of product and who then allow their emotions to govern the amount of depreciation charged. The amount of depreciation for any year, in fact, whether any depreciation shall be charged or not, is too often determined by the statement of net profits. In good years an excessively heavy depreciation may be charged; in poor years, none at all. One of the benign results of the Federal Income Tax has been that it forces manufacturers to be consistent in their handling of depreciation.

Conceivably, there are three methods by which the values of buildings and equipment might be figured, the forced sale value, the operating worth, and the cost of replacement. Many a long-winded discussion has taken place as to which of the three was proper. Fortunately, the Treasury Department has given us a ruling which takes this question out of the realm of argument. Buildings and equipment acquired since March 1, 1913, shall be depreciated on their cost. Equipment and buildings acquired prior to March 1, 1913, shall be depreciated on their fair value as of that date.

Another question which has caused a great deal of discussion is the rate of depreciation to be used. The principal cause of disagreement has come from an attempt to use a blanket rate to cover all of the buildings and equipment of a plant. A little clear thought should show that this is ridiculous. The type of construction of the building settles the rate at which it should be depreciated. To be exact, this requires the opinion of a capable engineer. A fair average, however, for the type of buildings ordinarily used by machine shops is 3½ per cent per year. Each machine should be studied in order to arrive at the correct rate of depreciation for it. Mere length of life is not the sole test. Possibility of obsolescence must also be considered. For instance, it is generally true that a drop hammer takes a slightly higher rate of depreciation than a drill press. An automatic machine, however, will have a much higher rate than either of the others, not due so much to greater wear and tear on the automatic as to the fact that new ideas in automatic machinery are being developed rapidly and there is much greater chance of the automatic becoming obsolete.

Because it is desirable to determine the depreciation for each individual item, it is well to record all equipment on some form of record. This may be either a book with a page for each machine and building or a card record. In Fig. 58 is shown a card form of equipment register which has been found to be simple to keep and effective. The sum of the total costs shown by all the cards should of course agree with the total of the asset account on the general ledger of the group to which it belongs.

For the shop which we are considering, the depreciation on machinery figures out to $27,389.12; for jigs, tools and fixtures, $14,129.82; for automobiles, $1,815.10; for the office, $12,000. The total depreciation on the buildings at the rate of 3½ per cent a year gives a money value of $15,833.69.



EQUIPMENT REGISTER

Mfr's. No. 106 — No. 16

Description: Single Head Mill. — Dep't. Mill

Est. Life 10 Years

Purchased From Rockford Milling Mach. Co. — Rate Dep. 10%

Built By — Annual Amt. $ 93.33

Size Driven Pulley 14 — H. P. R. 60 — Date Put In 6/6/15 — Date Inv'd. 7/10/15

DEPRECIATION: To Year / Total — DEPRECIATED VALUE

ITEM	AMOUNT	REMARKS
Pur. Price	800 00	Book Value, Jan. 1st, 1920 $ 465.33
Freight & Cart.	30 00	Est'l Scrap Value 100.00
Drive	75 00	
Installation	25 00	
Total Cost	930 00	

FIG. 58. EQUIPMENT REGISTER CARD

Let us say that the taxes, not including the Federal Income Tax, amount to $2,200; the insurance to $3,000, giving a total yearly fixed charge, including depreciation, of $65,567.73.

Each month we must charge into our expense of doing business one-twelfth of the total of this fixed charge. We now want to determine how this monthly charge of $5,463.97 finds its way into the product. This cannot be done correctly by spreading it over the entire output.

Apportioning of Fixed Charges

So that each department and, ultimately, each unit of output will carry its correct share of these fixed charges, we set up the fixed charge sheet, Fig. 59. Since our entire business is divided into departments, it is apparent that the fixed charges for buildings and machinery can be distributed among all departments. The fixed charges dependent upon the machinery in any department can be measured by the ratio which the value of the machinery in any department bears to the total value of machinery in the plant. The fixed charges on the building itself can most fairly be distributed to each department in the ratio which the floor space occupied by the department bears to the total floor space of the plant.

We therefore set up Fig. 59 in two parts. At the left is a list of the various departments of the plant. Immediately to the right of this column is the calculation for each item of fixed charge which is a charge on the building and may therefore be distributed on the square-foot basis. The next section of the fixed charge sheet comprises the calculations of the various items of fixed charges caused by the equipment and which is distributed in the ratio which the equipment in a department bears to the total equipment of the plant.

This makes it necessary to determine how much of our taxes, insurance and depreciation is incurred because of the buildings and how much because of the equipment. Equipment, we may say, includes not only machinery but jigs, tools, fixtures and furniture.

The plant register of which we have already spoken, shows a total valuation of buildings and equipment of $822,823.66, of which $452,391.67 is the value of the buildings. This is approximately 55 per cent of the total value. Now, the total taxes on the entire business were $2,200. Therefore, 55 per cent of it, or $1,221, are taxes on the buildings, and $979 on the equipment. Of the $3,000 insurance, we find in a similar way that 55 per cent or $1,650 is insurance on buildings and the rest, $1,350, is insurance on equipment. It should be apparent that distributing these two items of the fixed charge on the basis of value is entirely logical for both taxes and insurance depend upon value.

FIXED CHARGE SHEET

DEPARTMENTS	DISTRIBUTED ON FLOOR SPACE OCCUPIED: FLOOR SPACE OCCUPIED	PER CENT FLOOR SPACE TO TOTAL	BUILDING VALUE	DEPRECIATION	TAXES	INSURANCE	DISTRIBUTED ON MACHINE VALUE: MACHINERY VALUES	PER CENT DEPARTMENT VALUE TO TOTAL VALUE	DEPRECIATION	TAXES	INSURANCE	TOTALS: DEPRECIATION	TAXES	INSURANCE	GRAND TOTAL	MONTHLY CHARGE: DEPRECIATION	TAXES	INSURANCE	TOTAL
Boiler	3500 00	2 40	10855 00	361 01	26 80	39 60	2500 02	3 51	1179 00	32 99	45 50	659 01	62 29	85 10	1707 20	129 98	5 19	7 09	142 26
Power	5400 00	3 60	16262 50	540 01	43 96	59 40	17129 00	4 67	1589 17	45 23	62 37	2159 15	89 19	121 77	2370 09	179 95	7 43	10 14	197 50
Office	4560 00	3 04	13749 67	481 58	37 15	50 01	12189 19	3 29	1200 00	32 21	44 42	1681 58	69 36	94 43	1845 10	140 11	5 77	7 87	153 75
Tool Room	7200 00	4 80	21710 00	780 03	58 61	79 35	18001 12	4 86	2563 64	47 58	65 61	3328 06	106 19	144 96	3575 01	276 95	8 85	12 09	297 91
General Factory	13590 00	9 06	41905 55	1466 35	113 06	152 79	45179 00	12 19	4721 15	119 54	164 55	6187 49	232 60	317 34	6737 20	515 65	19 47	26 45	561 49
Automatic	17850 00	11 90	55834 60	1884 21	145 30	198 35	67478 06	18 21	8777 45	178 25	245 66	10661 66	323 55	442 19	11427 45	888 47	26 97	36 85	952 29
Milling	3000 00	2 00	9047 85	316 67	24 42	33 00	3712819	1 00	395168	96 89	135 56	4268 27	122 81	168 56	4559 62	355 69	10 23	14 05	379 97
Lathe	15400 00	10 26	70573 10	2470 01	190 45	257 40	87192 00	23 55	9102 30	231 30	317 95	11572 31	421 75	575 35	12569 41	964 35	35 15	47 95	1047 45
Planer	9000 00	6 00	27143 50	950 03	73 26	99 00	35529 00	9 59	3829 40	93 87	129 47	4579 12	167 13	228 47	4974 72	381 59	13 93	19 04	414 56
Polishing	3000 00	2 00	9047 85	316 67	24 42	33 00	2725 69	74	294 90	7 25	9 95	613 47	31 67	42 95	687 09	51 12	2 64	3 57	57 33
Hardening	18000 00	12 00	54287 00	1900 00	146 52	198 00	14120 52	3 81	4128 00	98 30	51 44	6028 30	182 82	249 44	6460 56	502 35	15 25	20 79	538 39
Assembling	29000 00	19 33	81485 50	2850 01	219 78	297 00	98850 00	26 71	10512 00	261 41	360 25	13902 01	245 93	337 06	14485 00	1158 17	20 49	27 75	1206 41
Shipping	12000 00	8 00	36191 13	1266 70	97 68	132 00	11575 00	3 01	2542 90	30 06	41 45	3629 00	127 74	173 45	3910 19	300 64	10 64	14 45	325 93
Selling	2100 00	1 40	6333 48	221 67	17 09	25 10						221 67	17 09	25 10	261 86	18 47	1 42	1 93	21 82
TOTAL	150000 00	100 00	452391 67	15839 69	1221 00	1650 00	370431 92	100 00	45538 42	979 00	1350 00	60367 73	2200 00	3000 00	65567 73	5030 64	183 35	250 00	5463 97

FIG. 59. FIXED CHARGE SHEET

TOTAL CHARGE			MONTHLY CHARGE (Basis Journal Entry)		
Mach. Dept.	44534 04		Mach. Dept.	3711 17	
Bldg. Dept.	1683 38		Bldg. Dept.	131 94	
Total Dept.		60367 73	Mfg. Exp.		5030 64
Mach. Taxes	979 00		Mach. Dept.	81 58	
Bldg. Taxes	1221 00		Bldg. Dept.	101 75	
Total Taxes		2200 00	Mfg. Exp.		183 33
Mach. Ins.	1350 00		Mach. Dept.	112 50	
Bldg. Ins.	1650 00		Bldg. Dept.	137 50	
Total Ins.		3000 00	Mfg. Exp.		250 00
TOTAL		65567 73			5463 97

We must now divide the fixed charges of the buildings which we have just determined in lump sums among the various departments. The sums we have arrived at are therefore entered at the foot of the columns under building depreciation, building taxes and building insurance. These, as we have seen, are to be divided among the various departments in the ratio which the departmental area bears to the total area of the plant. This is obviously done by measuring the area of the departments, either in the plant itself or on a scale drawing if that is available. At this point, it is well to bring in a check on the accuracy of the figures and see that the sum of the departmental areas as measured equals the total area of the plant.

We have now distributed the fixed charges on the buildings to the various departments. The next step is to distribute those charges which are incurred on the equipment. We have seen that the logical way to make this distribution of insurance and taxes is on the basis of the amount of equipment in each department. We therefore add up all of the equipment listed on the plant register in order to get the total for the plant. For the shop which we are considering, the total of this amount is $370,431.99. We now determine the exact amount of equipment in each department and calculate what per cent of the total equipment each department contains. In the case of the office, for instance, we find that it contains $12,189.19 worth of equipment which is 3.29 per cent of the total.

This department will therefore bear 3.29 per cent of the total fixed charges on equipment, which will amount to $32.21 for taxes and $44.42 for insurance.

The depreciation on equipment is calculated from the Equipment Register cards. As the rate for departments and even different machines in a department will vary, the final figure for each department is the aggregate of the individual figures shown on the register cards. The total equipment depreciation for the plant is, therefore, the sum of the individual depreciation figures, instead of, as in the case of taxes and insurance, being a known total divided upon a percentage basis.

In the lower right-hand corner of the fixed charge sheet we gather together the total depreciation, total taxes and total insurance on a monthly basis in order to prove that we are absorbing, each month, into our departmental expense, the amounts which have been set up on the fixed charge sheet. This also serves as a memorandum on which the cost department makes up the proper journal entries which they give each month to the accounting department.

In practice, it is well to revise the fixed charge sheet about every six months so as to be able to make proper corrections for equipment which has been transferred from department to department and to take care of the installation of new machinery. This is made easy when a plant equipment record, such as has been mentioned, is used. Care put on keeping the plant equipment record up to date will be very well repaid in arriving at actual cost figures. Sometimes, of course, no changes in equipment have been made, in which event it is unnecessary to revise the fixed charge sheet.

Automotive Engineering Standardization and Progress

By COKER F. CLARKSON
General Manager, Society of Automotive Engineers

STANDARDIZATION is the codification of the best consensus of opinion as to what should be specified for those items of materials and dimensions which it is clear can be reduced advantageously to common practice. The purpose is, of course, to improve the conditions of manufacture and operation. The draftsman's time is saved and made more efficient. There is established a very helpful *esprit de corps* as to what can and shoud be done in the way of standardization. The stocking of materials and many component parts of subassemblies becomes possible, time being again saved. The product is improved in quality both as a whole and in detail. Price always tends to become relatively less. The user can maintain the apparatus he has bought more economically as to time and in a pecuniary way. He gains increased knowledge of and confidence in the manufacturer's product by finding therein detail features of construction which are generally known and accepted as good. This is akin to one of the most potent principles of advertising; a feeling of plausibility and propriety is engendered through the effect of general publicity. Common knowledge of this sort is beneficial in all effective commercial operations.

The world would be in a more deplorable state if it did not have a great mass of what are standards in varying degree, although these are not generally appreciated to be standards in the sense that we are considering them. Among such standards are sizes of wearing apparel and of numberless other commodities that readily come to mind. These are not necessarily standards of a high degree of accuracy, such as standards of units of measurement, time and quantity.

One troublesome misconception of the standards we are discussing is that they are mandatory. Another is that they are manifestos of finality like standards of weight or measure. An automotive engineering standard is a thing that is considered, by men well qualified to judge, good or best for the great bulk of the manufacture in our field, in order to facilitate quantity production in the way I have indicated. The Society of Automotive Engineers has no way of enforcing the use of its standards except in so far as their merit is weighty. This is as it should be, and for a like reason the S. A. E. standards work has been successful. It has been demonstrated over a period of years that most of the standards can be reduced to practice by the great majority of manufacturers with marked benefit to themselves, as well as their customers, in fact in all cases where the production is not really special, inherently, or on account of large substantially identical previous production not incorporating the currently desirable standards. The latter condition is almost inevitably a matter of the relative importance of the past and the future to the manufacturer.

*Address at National Gas Engine Association Meeting.

The Society of Automotive Engineers is not commercial in the sense that it can enforce its standards in an arbitrary way. It is commercial in the sense that its standards are of commercial value. The society can conduct its activities on a somewhat broader and less partisan basis than a commercial organization can. A commercial organization of manufacturers, proceeding as such, without giving effect to engineering questions as such, cannot on account of sales competitive reasons get as good results in the formulation of engineering standards as an organization like the S. A. E. can. In more than one instance the society has established standards that have gone into general practice, after the representatives of the manufacturers directly concerned working together, or failing to work together, had been unable to establish them.

Standards should, of course, be canceled or revised when necessary. They should not obviously be promulgated originally unless there is sufficient evidence to assure their holding good for a properly long period of time. But the whole system should be conducted flexibly and not inflexibly.

The more or less chronic stock argument against standardization is that it impedes individual and engineering progress. This is the sort of argument that is legion and perennial in almost every field of endeavor. I believe that no fair-minded man would say that standardization had impeded the progress of the automobile industry. There is every evidence that it has been one of the main reasons for the quantity production in this field, facilitating purchase of materials, improving quality and decreasing cost of maintenance. Quantity production is clearly not possible without a great degree of standardization of some kind, and the standardization the S. A. E. has fostered has surely been most advantageous to the great majority of manufacturers and users in the automotive field. There is a very material saving in the manufacturing cost per car. Screws, taps, dies, spark-plugs, steels and many other materials and parts can be bought at lower prices and for better delivery. The producing companies have saved a great deal of money in lowered materials costs and in lessened production complications. There is no doubt that the standards and recommended practices of the Society of Automotive Engineers have been of incalculable benefit to the automotive industry at large. The cost to the consumer of standard gages has been reduced greatly, compared to what it was when gages were made specially to meet customers' requirements. It is stated that 95 per cent of the lock-washers used in automobile fabrication and operation are S. A. E. standard. These are merely examples of a widespread condition as to S. A. E. standards and recommended practices.

A fundamental maxim of the S. A. E. has always been not to endorse or condemn any proprietary article, nor to endeavor to standardize any practice that would impede progress in design. As a class the standards consist of material and mounting-dimension specifications for those things that are essential in the present types of automotive apparatus. Incidentally it cannot be ignored that the greatest successes have been attained in those automotive fields in which the design of the articles produced has been most conventionalized, conspicuously in the automobile field. Much conventionalization is essential in great commercial success with apparatus individually operated by a large number of people in a mechanical way. The most advanced and efficient apparatus cannot necessarily be operated by the average user. The generally prevalent knowledge of the internal-combustion engine is a principal reason for the success of the vast amount of automotive apparatus in use. Intelligent standardization cannot check but can only assist such a condition. There is no trade advantage to any single company in not participating in the establishment and practice of rational standardization. Neither is there any advantage in the way of design.

In England, recently, there was designed a simple and inexpensive stationary engine for general purposes, such as dynamo driving and farm work, and at the same time to obtain the very high efficiency which had been attained thitherto only in very costly engines, such as those used for aircraft. It is stated that during a 100-hr. run developing 6 hp., at less than 750 r.p.m. governed speed, the fuel consumption was a little over ½ pt. per horsepower-hour, most engines of a similar size consuming ¾ pt. per horsepower-hour. It was figured that with this type of engine the money saving per year for fuel would be $65 per engine. The engine was single-cylinder 4 x 6 in. The oil consumed was 0.012 pt. per horsepower-hour. This performance is decidedly an example of appealing engineering progress. The work of the Society of Automotive Engineers in standardization, research and other respects, has been and is primarily such as to encourage such development, and not in the least to impede it. The whole purpose of the society is to bring about improvement in the entire automotive field, increasing the efficiency of engines and power transmitting devices.

The automotive world is one large growing family, both nationally and internationally, and is making every effort to further and make as effective as possible those phases of efficient production of automotive apparatus of great merit, in which the engineering fraternity takes such a deep interest and which are so essential to the nation industrially and economically. In worldwide trade it is obvious that the maintenance of standardization that will make possible the interchangeability of many materials, parts and accessories, is economically requisite.

Getting the Right Man Through the "Help Wanted" Columns

By A. W. Forbes

On page 611 of the *American Machinist* the article, "Putting Punch Into 'Help Wanted' Ads," appears to be only interested in the quantity of applicants. Quantity may be of interest to some; to others, quality is the only consideration. The big fault that I find with "Help Wanted" ads is the number of applicants it is necessary to meet in order to select one.

In talking with a factory manager, I showed one of the advertisements I was planning to use, and received the reply, "It makes no difference what you say in the advertisement. Anyone who is out of a job will apply anyway." Perhaps this was an exaggeration, but the results seemed to show that it was not.

The advertisement was a blind, but I received a good number of letters in reply. Of these not one showed that he had any of the qualifications called for; not one did I consider worth a reply.

The question I am interested in is not how to put punch into the advertisements. It is how to write the advertisements so that those who are not qualified will not apply.

A Worth-While Training Department

By L. C. MORROW
Assistant Managing Editor, *American Machinist*

Training departments, or vestibule schools, are contributing to the machine industry the greater portion of its skilled mechanics. To a marked extent the quality of the mechanic depends upon the instruction he receives. The worth-while training department told of here is part of a large machine-tool plant in Cincinnati. The department is two years old, its methods have proved to be practicable, and it is turning out efficient young men for the plant.

THE American Tool Works Co., Cincinnati, is operating a training department which parallels the "vestibule schools" of other plants. It was organized about two years ago for the immediate purpose of instructing the unskilled, whom the company found it necessary to take on for war work. However, the organizers established the school with a foresight of its present uses, which include the instruction of several groups, viz.: the specialized worker, who will operate a strictly production machine; the apprentice; the embryo salesman; the young draftsman; and high school and university co-operative students.

FIG. 1. THE TRAINING DEPARTMENT

The training department, shown in Fig. 1, is on the fifth, or top floor, thus obtaining the advantage of good light. There are allotted to it 1,500 sq.ft. of floor space, screened off from the remainder of the plant. Screening definitely bounds the working home of the student, and keeps away from him the merely curious, the too willing volunteer assistants, and the meddlers.

The equipment of the training department is representative of the plant. There are included one 14-in. x 6-ft. lathe, three 16-in. x 8-ft. lathes, two 28-in. shapers, one 24-in. planer, one 2-ft. radial drilling machine, one No. 2 universal milling machine, one speed lathe, one tool grinding machine, one arbor press, one bench grinding machine, three assembly benches and fourteen vises. It has been the policy to choose heavy machines, so that more than the run of small work usually allotted to a school can be handled.

There are two kinds of students—exclusive of those to be trained as salesmen and draftsmen—specialists and apprentices. The specialist is a student who is to go on a specialized job and stay there. He is given instruction only on the machine which he is to operate, or in the line of work he is to pursue. On the average, this work requires about two weeks of instruction.

The apprentice is a young man who has signed an agreement to learn the machinist's trade in the employ of the company, his apprenticeship to extend over a period of four years. The length of the initial stay of the apprentice in the training department is from one month to six weeks. The instruction received and the experience gained during this time fit him for machine-shop work in general and especially for the work of the first department to which he is to be sent. As often as he is changed from one department of the shop to another, he will be sent back to the training department for instruction in the new department. The course, therefore, permits the apprentice to be instructed on all machines and to work in all departments. Furthermore, it permits the spreading out of his instruction over a period of four years and the immediate application of the instruction for each division of work.

After a month's trial in the training department the apprentice receives a toolbox and tools as shown in Fig. 2. These tools he uses as long as he is an apprentice. They become his personal property upon comple-

tion of his apprenticeship. They, and the one hundred dollars paid him at the same time, set him right on his feet just as he begins to travel alone. This tool equipment means much to the boy who takes pride in tools and who has to use them. But it means much more to the boy who in addition is too poor to buy them. The following is a list of the tools included in the set:

1—Toolbox, No. 10 Pilloid, oak finish
1—¾-lb. ball peen hammer.
1—No. 72 Starret thickness gage
1—1-in. Slocomb micrometer
1—2-in. Slocomb micrometer
1—6-in. perfect handle screwdriver
1—9-in. perfect handle screwdriver
1—12-in. perfect handle screwdriver
1—6-in. No. 61 Starret try square
1—Center punch
1—3-in. outside spring caliper
1—3-in. inside spring caliper
1—6-in. outside spring caliper
1—6-in. inside spring caliper

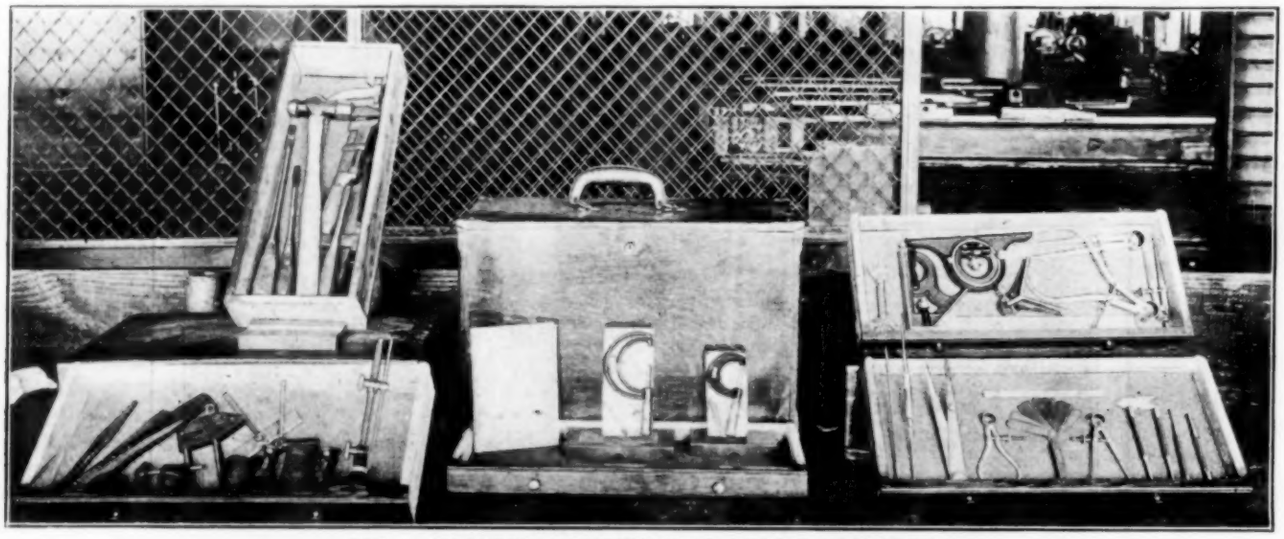


FIG. 2. TOOLBOX AND TOOLS GIVEN TO APPRENTICE

1—6-in. hermaphrodite caliper
2—Starret jack screws, No. 190, with attachment
1—Parallel clamp, Starret, No. 161 C
1—12-in. combination square
1—8-in. Coes knife handle monkey wrench
3—Assorted pin punches
1—Pair 4-in. dividers
1—No. 67 Starret improved scriber
1—Adjustable hack saw frame
1—Surface gage
1—Depth gage
1—Screw pitch gage
1—Center gage
1—6-in. flexible scale
1—Set P & W micrometer standards, 0.2 in. to 2 in.

INSTRUCTION

The first day spent by the apprentice in the training department is devoted to the study of decimals, as it is found that the majority of them do not understand this important subject. How to read the micrometer is included in the lessons on decimals. Should half a day prove insufficient for this work, more time is devoted. Instruction in vise or machine work is begun immediately thereafter.

Vise work is taught partly by example. Two or three good mechanics do their regular work in the training department, acting as examples for the apprentices. It seems that this method is especially well suited for teaching vise work, as filing, scraping, hand tapping and fitting require a great deal of demonstration as well as practice. An assistant instructor, a competent mechanic, is in charge of the vise department. Such units as belt shifters, apron controls for motor driven lathes, lathe turrets and relieving attachments are assembled. Burring is the first operation attempted. It is followed by filing, fitting and assembling.

The first step in machine work is usually the hardest. In this school it consists of learning the machine—what it is for, how it is operated and how to oil it. About the third day the student is started on machining some simple part and from that on his advancement depends directly upon his ability. Each and every piece sent to the department is part of the run of work of the plant and is to be used in assembly. The simple pieces include collars, belt shifter parts and other pieces which require straight turning.

At this stage the student either goes on, drops out or is requested to drop out, as this has been determined by the instructor in charge to be the time at which the adaptability of the student has been tested.

Class instruction is given in shop work, but never in general educational subjects. Such subjects are taught in the Cincinnati public night schools, and since the apprentice is obliged to attend the night schools according to his agreement with the firm, it is not considered necessary to duplicate this work. The boys are required to take mathematics and mechanical drawing at the night school. The class instruction is not according to a prearranged schedule; the students are assembled as occasion arises and given group instruction in the various problems that present themselves.

Throughout the progress of the apprentice through the shop and after he is finally placed in the shop the instructor follows him up, working in conjunction with the foreman of the department to see that he understands his work and is doing it properly. This is a valuable and noteworthy feature, inasmuch as it makes possible a repositioning of the apprentice if he is found not adaptable to the department first chosen. This function of the instructor and the changing about of the employee also apply to the specialized worker, who has been instructed in the training department.

Another phase of the work done in the training department of the American Tool Works Co. is that of instructing men who are to become salesmen. These men are placed in the department under the supervision of the instructor and the construction and operation of the machines they are going to sell are taught them. After completing this course of study they are sent to the shop, where they are shifted about from department to department according to their needs, with a fairly close adherence to a prearranged schedule.

It has been found advisable to instruct girls who work in the drafting room along certain practical lines such as phraseology, nomenclature and function of the parts going to make up the machines manufactured by the plant. The time devoted to this is one-half hour on alternate days and the work has very fittingly been placed under the head of the training department. A similar course is given to the younger male draftsmen.

ordinarily occur, and there is a consequent saving in the cost of hiring and firing.

To further the work, and instill interest in and respect for the trade, an apprentice club has been formed. It is an organization of the apprentices, under a set of rules along parliamentary lines, which meets every other week at the plant, for reading and discussion of papers prepared by the apprentices themselves. They have used such topics as "Safety First," "History of the Machine-Tool Industry in Cincinnati" and "History of the Lathe." It is obvious that the student must do some excellent work in reading and investigating to prepare on such subjects. His ability to face his fellow men in argument and speech is developed and therefore so are his self-respect and confidence. Visitors are frequently allowed to address the club on pertinent topics. No attempt is made in a social way except so far as the method develops poise and self-respect.

FIG. 3. INSTRUCTORS AND APPRENTICES

During the two years of operation of the department 245 students have been enrolled and the majority of them graduated on specialized work. Of these 40 were girls. The normal capacity of the training department is twenty-five pupils; at present seventeen are enrolled in the apprentice course. The system of instructing students for one department for a short time and then placing them in that department for experience, later taking them back to the school, permits a large enrollment with a comparatively light burden on the school at any one time. The average age of the students is 18 years and their schooling, on the average, has taken them through the eighth grade. Fig. 3 shows the present group of students.

The cost of hiring and firing a mechanic is well known. This cost ordinarily applies to an apprentice or an employee for specialized work just as it does to a skilled worker. By the interposition of the training department between the employment office and the shop, about 35 per cent of the applicants sent to the training department have been classed as not fitted or adaptable and therefore eliminated. This is accomplished with much less spoilage and loss of machine-time than would

The training department is approved and backed by the shop. Ample evidence of the truth of this statement is given by the success of the students when placed in the shop.

The management is responsible for the school, and explains the necessity for, and the value of it in the following way:

There exists in the machine industry a shortage of skilled mechanics, due largely to the natural growth of the industry. This increase is due to a constantly increasing and developing demand for materials which only the machine industry can supply, of which plumbing supplies and household labor saving devices afford two very good examples. New shops are springing up, and if successful, are growing. Along with this increase in the demand for skilled mechanics there is no central producer of them, and but comparatively few individul producers, i.e., educators and trainers. So it is up to the industry itself to make its mechanics. Nor should this burden be entirely shouldered by a few large shops. Each shop, no matter how small, owes it to the industry to develop a quota of mechanics proportionate to its requirements. The small shop can afford to allot a part

of the time of one or two machines and a smaller part of the time of a good mechanic to this work. There is offered by the small shop owner the argument that in all probability his apprentice will quit him about as soon as he is trained. Possibly. The small shop has then but contributed to a cause to which it owes a contribution. With all shops doing their rightful shares of the same kind of production—that of skilled mechanics—the small shop owner's chances of losing the man he trained are decreased and his chances for replacing him, if lost, are increased.

Among present-day and everyday problems are the selection and procurement of machines, materials and supplies. These are given careful consideration. The selection and procurement of the human part of the factory also receives consideration, but to a much smaller degree and very frequently misdirected. Rather than continually sort over goods on hand, much of which has been already rejected, start with the raw material and manufacture new goods—in other words train men for the industry. As a corollary of this proposition it should be borne in mind that foremen, necessary and controlling factors that they are, are made, not born, and that the way to possess foremen who are modern, in sympathy with present-day production methods and not limited by early conceptions of what can and what cannot be done, is to make them. A training department which will make intelligent mechanics and eliminate the poorer grade is serving the purpose of producing foremen.

It is also the belief of the management that such a training department should confine its efforts to those lines which are to be directly applied to the shop, leaving the so-called higher education to the day and night public schools.

Valuable Features of the Training Department

Not the least valuable feature of the American Tool Works' training department is that nothing is done just as practice. Everything made is bona fide production goods and is used in the company's assembly. Premium work is not attempted, as the object of the department is to teach how to do work accurately rather than rapidly. The speed is gained in the shop.

Another feature of merit, helpful to school and shop alike, is the practice of the plant in sending to the training department the various odd jobs of maintenance and repair. To call forth the exercise of thought and resourcefulness of the student, there is no better work. Of course its value to the shop lies in preventing interruptions of production for non-productive work.

A phase of the work of the training department which adds to the value of the department is that of instructing high school and university co-operative students. The high school course is of two years' duration and the student, while at the shop, pursues a course in practical shop practice in the training department which fits him to take his place in some department of the plant. He also signs an agreement and receives a tool box and tools, although not of the same value as that of the apprentice. Cincinnati University co-operative engineering students as a rule begin their work in the plants a few months before the beginning of the collegiate year. At the American Tool Works' plant they are given, during these few months, a course in the training department which acquaints them with the rudiments of machine work, and no doubt is of noticeable benefit to them in their later work.

The immediate benefits derived from a training department such as that described are many. Future benefits can only be guessed at. They will lie in a financial gain due to more efficient workers, and in the virtue and influence of high-class training department graduates who have grown up with a spirit of loyalty and co-operation.

A Suggestion in the Matter of Designating Finishes

By Jack Homewood

There is great disadvantage in having work done in an outside shop where it is not convenient to give a few personal instructions, such as finishes, fits, and other details, in addition to the information imparted by the blueprint. Can we not make the blueprint more "human" so that it will become more nearly automatic in its instructions to the craft in general by the incorporation of a set of standard symbols?

The ordinary run of workmen do not seem to be able to discriminate in the matter of finishes required on a job. Some men will decorate a job with elaborate finishes and some go so far as to mottle it in spots. It may look very nice to the eye but when such finish is unnecessary it is hard on the pocketbook of the man that has to pay for it.

Other men are just the opposite; they will not use their heads in putting on a finish. They may be over anxious to get the job off of their hands, but there is a little touch of carelessness in not going far enough. A foreman has enough to do without being obliged to attend to every little detail pertaining to the work; he shouldn't have to take a job back to a man and tell him to take a burr off here and there, and he shouldn't be subjected to a "calling down" from the man higher up owing to the elaborateness of one of his men when he was too busy himself with other work to watch the man. He shouldn't be compelled to go to the man after the thing is done and "bawl him out" for his folly.

Some men do not use their brains when it comes to finishes; why depend on them to do so (at the employer's expense) when it can be avoided? We could have a system of symbols that the mechanics could accustom themselves to, just as they do the decimal equivalents. It could be on the order of the following:

FINISHES

(a) Rough casting finish. Burrs and sand removed.
(b) Ground to a finish so as to not injure the hands.
(c) Rough machine finish to have a plane surface.
(d) Broad nose tool finish.
(e) Filed finish.
(f) Scraped finish, several grades: (1), (2), (3).
(g) Mottled finish.
(h) Rough steel finish, scale not removed.
(i) Machine ground finish.
(j) Whatever finish is left after hardening.
(k) Lapped.
(l) Highly polished.

FITS

(m) Running fit.
(n) Rifle fit, to push through by wringing.
(o) Sloppy fit.
(p) Press fit.
(q) Hydraulic fit (specify tons).
(r) Shrink fit (specify amount).

HARDNESS

(s) Very hard (plug gages, etc.).
(t) Cutting hard (for a cutting tool).
(u) Chipping hard (for chisels, sets, etc.)
(v) Spring temper.

The above may look to some like red tape with corrugated edges but the trouble to be overcome is real and this is at least a suggestion for a remedy.

Contracts With Labor Unions

BY CHESLA C. SHERLOCK

During these turbulent labor times an article of this nature carries a wealth of enlightening information. Just what the law covers, with regard to disputes between employers and labor unions, is clearly defined.

NO PHASE of the present industrial situation is as timely or interesting as a discussion of contracts with labor unions and the legal points involved.

Trades unions are of comparatively recent origin. They were unknown at common law and just what the courts of those days might have said in connection with the subject is a matter of conjecture. The law has always been reluctant to recognize any body of individuals more or less loosely associated together, having an undefined interest in the enterprise for which they are associated, assuming none of the liabilities of the common purpose, as is always the case where individuals mass together for a specific object but fail or refuse to associate themselves in the manner prescribed by the law itself.

Employers have come in recent years to the point where they freely enter into contracts with the representatives of trades unions, in respect to the hours of work, working conditions, the amount of payment and such other matters as peculiarly affect the individual member of the union.

THE CONTRACT

The contract, it will be noted, is entered into on the one hand by the employer—an individual. He may be merely a private individual, a partnership or a corporation. In either sense, he is an individual at law, for from the earliest dawn of time the law has ever sought to deal with *individuals* and not with masses, in so far as specific rights and obligations are concerned. Hence, the use at law of the partnership and the corporate idea.

In the old days, under the common law and back under the ancient law before the Romans gave us the modern corporation, men could not contract together except as individuals. The law could not recognize, in any sense, a status where the individual responsibility of the individual might in any way be obscured or lost sight of when the day of *performance* of the covenant arrived. And, indeed, the sole satisfaction which could be obtained in a contract in those days was by its performance by each individual according to the letter thereof. Shylock was entitled to his pound of flesh and he had a right to it.

All this is interesting when we stop to think that the contracts which employers have been making with labor unions have been outside this old conception of mass contracts. In the case of the labor union, we have representatives coming to the employer and signing a contract with him on behalf of a number of individuals, who are looked upon to perform their portion of the agreement.

From an individual standpoint, the members of the union are not bound to do anything absolutely. The employer may contract with a union representative having in mind that he is to have the service of the members now in his employ. But these members can quit work tomorrow if the spirit so moves them, and less competent and less faithful members substituted in their place.

On the other hand, suppose that the union representative makes an agreement that is distasteful to the individual members. Can the employer force the individual members to live up to the agreement made by their representative? If, at law, he has this technical right, just what can he do to enforce it? Especially, in view of the facts we have set out a few paragraphs above concerning the inability to reach the individual where an agreement has been made with an irresponsible mass.

And, again, suppose that the contract is highly satisfactory to the individual workmen members of the union, but that a change in circumstances makes it highly burdensome upon the employer. Can he refuse to perform his share of the agreement without laying himself liable to individual actions for damages instituted by his employees who are members of the union?

These are only a few of the questions which arise in connection with the contracts which employers are making with the representatives of trades unions. It marks a new departure in the law of contracts, and a new feeling on the part of the courts, doubtless dictated by that poor maker of laws, expediency.

These considerations kept in mind will serve a very useful purpose as we examine the trend of the decisions and see just what the thought of the respective authorities has been in the past.

SOME LEGAL DECISIONS ON THIS QUESTION

The Kentucky court, in considering a contract where the individual employees were seeking to bring actions against their employer because he had broken the contract entered into with their union representatives, said: "A labor union, in contracting with an employer with respect to wages and conditions of service for a specified period of time, does not establish contracts between its individual members and the employer, a breach of which will sustain actions by the individuals."

In Missouri, it was held that a miners' union as an organization cannot make a contract for its individual members in respect to the performance of work and the payment for it. It is, however, conceded that a labor organization may have rules requiring an employer to designate certain pay days, and, in such case, the employer of a member of the organization who agrees that the employee is to be paid on the designated pay days as established by these rules, thereby makes the contract or rules fix the time of payment. But this is upon the theory that the individual so contracts, and not upon account of his being a member of the organization which has undertaken to contract for him. And a contract on the part of an individual that he will perform certain work under the rules of an organization is not to be inferred from the simple fact that he is a member thereof.

"Persons work for themselves and are free and independent, and agreements improving conditions can only

be enforced when the entire proposition has been stated and by them freely accepted. Hence, where there is no express agreement between the employer and the employee as to the performance of the work involved in the contract, or the time of payment therefor, the law by implication and not by contract between the employer and the labor organization of which the employee is a member, fixes the status of the parties in respect to such work, and when the consideration becomes due and payable."

This view of the matter is consistent with the attitude which the courts have taken from time immemorial in regard to contracts of this nature. It denies the right of a union to enter into agreements which will be binding upon its members as individuals, and the only way in which the employer can be held to maintain certain pay days is by implication and not in any sense by reason of contract.

A New York Case

In New York, the court said: "A contract between an employer of labor and a labor union, by which the employer agrees not to employ non-union labor is valid where it results in financial benefit to the employer and disposes of differences between the employer and a labor organization, provided the agreement is not entered into for the malicious purpose of injuring the non-union employees of such employer, and without the object of compelling such employees to join the union, and no pressure so imperative as to amount to compulsion is exerted upon the employer with regard to the discharge of non-union employees, and there is no conspiracy to compel the latter to join the union, or solely to injure them in their employment."

It can be seen very readily that if the officers of a union enter into a contract with an employer with respect to the employment of none but union workmen, and that if they are actuated by the motives usually credited to them, the contract would not be valid or enforceable in the courts.

It must be kept in mind, however, that this decision rests upon the fact that the employer, at the time of the making of the agreement, had in his employ a number of non-union workmen. A different situation might arise in a shop where all the workers were members of the union, or where the employer was engaging a new force entirely, as where a new concern might just be commencing business.

In fact, in another case involving the different set of facts mentioned, the New York court has said: "A contract by an employer to employ union labor exclusively is valid, at least where the restraint imposed is not unreasonable in view of the surrounding facts and circumstances. Thus, it has been held that a contract by an employer of labor by which he binds himself to employ, and to retain in his employ, only members in good standing of a single labor union, is consonant with public policy and therefore enforceable."

The Spirit of Contracts

It is fundamental in the law of contracts, that no agreement which is grounded in malice, or which seeks, by the use of force, coercion, compulsion or intimidation, to secure some sort of advantage to any of the parties, can be valid. Labor unions cannot, in making such a contract and in driving out non-union workmen, still expect to enjoy the advantages they obtain under such contract by enforcing it, if they have resorted to any of the means not tolerated by the law in obtaining it in the first instance.

The mere fact, however, that an employer enters into such an agreement and that it will injure others, is not sufficient to invalidate the agreement, if it is faultless in other particulars.

The Federal court has said: ". . . a laborer, as well as a builder, trader, or manufacturer, has the right to conduct his affairs in any lawful manner, even though he may thereby injure others. So, several laborers and builders may combine for mutual advantage, and, so long as the motive is not malicious, the object not unlawful nor oppressive, and the means neither deceitful nor fraudulent, the result is not a conspiracy, although it may necessarily work injury to other persons. The damage to such persons may be serious—it may even extend to their ruin—but, if it is inflicted by a combination in the legitimate pursuit of its own affairs, it is *damnum absque injuria* (injury without liability). The damage is present but the unlawful object is absent. And so the essential question must always be whether the object of a combination is to do harm to others, or to exercise the rights of the parties for their own benefit."

The courts, then, care not so much about the object accomplished as they do about the motive. The object may be apparently harmless or at least not out of the ordinary, but if the motive is malicious or unlawful, it will not condone the agreement, however beneficial or harmless the result may be. In fact, this is the identical principle underlying combination agreements as applied to business generally. The cornerstone of the trust laws is none the less greater than this very principle. In fact, this identical expression is the very root of the anti-trust theory and of the statutes and decisions handed down on the subject.

Combinations Allowed by Law

Men may combine, but they must be honest and lawful in their intentions and in the measures which they take to bring about the ultimate object they have in view. This is no harsh dictum applying to labor unions and the agreements they make alone; it applies to every business man just as forcibly.

In another case, the Federal court has said: "The inherent right of the individual laborer to sell his labor, which is his property, in any lawful manner or pursuit, and upon such terms and conditions as he may himself determine to be for his personal best interests, must be upheld by the law just as fully and freely regardless of these union organizations, as it is upheld in all the other relations of our civic life."

No organization, no association, no corporation, no union, can be higher or mightier than the individual in the eye of the law. The courts have ever sought to preserve the individual integrity of each person, no more so than in the law of contracts.

An examination of this point under the law convinces us that an agreement between an employer and a labor union which is absolutely valid and binding, as we find contracts made under other conditions, is a very rare thing. It is not an impossibility, by any means, but it is seemingly improbable, even in those states or jurisdictions where the courts say such agreements "may" be recognized. Some states, as we have noted, consider them invalid from the very beginning.

Derivation of a Formula to Determine Number of Teeth in Contact of Two Meshing Gears

By A. B. COX

The author derives a formula by which may be determined the number of teeth in contact of two meshing gears and gives graphic representations of the results of the application of this formula. He also specifies the disadvantages of the length of addendum of standard gears.

IF IT be assumed that the teeth of a pair of gears in mesh with each other are so accurately cut that all the teeth which theoretically should be in contact are actually in contact, this number can easily be calculated. The numbers of teeth in contact with gears of any ratio and any numbers of teeth can be calculated and plotted in curve form from which certain conclusions of practical value may be drawn.

The following symbols are used throughout this treatise:

P = diametral pitch.
P_c = circular pitch.
ϕ = angle of line of action (degree of involute).
n = number of teeth in pinion.
N = number of teeth in gear.
r = pitch radius of pinion.
K = $n \div N$
x = co-ordinate of point of intersection of line of action with outside diameter of pinion with center of pinion as origin.
L_p = length of line of action intercepted by line of centers and outside diameter of pinion.
L_g = length of line of action intercepted by line of centers and outside diameter of gear.
L_r = length of line of action intercepted by line of centers and top of tooth of rack.
L_T = $L_p + L_g$, or $L_p + L_r$
M_p = $L_p \div P_c \cos \phi$
M_g = $L_g \div P_c \cos \phi$
M_r = $L_r \div P_c \cos \phi$
M_T = total number of teeth in contact in a meshing gear and pinion = $M_p + M_g$, or $M_p + M_r$.

Referring to Fig. 1, it is seen that the tooth contacts are made only on the line of action, and that the distance measured on the line of action from a point on one tooth to a corresponding point on the next tooth is $P_c \cos \phi$. To find the total number of teeth M_T in contact it is therefore only necessary to find the total length L_T of the line of action and divide it by $P_c \cos \phi$. The integral part of this number M_T indicates the minimum number of teeth that will always be in contact (in this case two) and the decimal part of the number indicates the relative length of time the additional tooth will be in contact. In solving this problem it has been found more convenient to find the number of teeth in contact M_p for the pinion only and add to this the number of teeth in contact M_r or M_g, for the rack or gear, i.e., $M_T = M_r$ or $M_g + M_p$.

The derivation of the formula for M_p is as follows:

$$x^2 + y^2 = \left(r + \frac{1}{P}\right)^2.$$

$$x^2 + y^2 = \frac{r^2}{n^2}(n + 2)^2$$

which is the equation of the outside diameter of the pinion.

$$y^2 = (x \tan \phi + r)^2$$

which is the equation of the line of action.

$$x^2 + (x \tan \phi + r)^2 = \frac{r^2}{n^2}(n + 2)^2$$

$$x^2 + x^2 \tan^2 \phi + 2xr \tan \phi + r^2 = \frac{(n^2 r^2 + 4nr^2 + 4r^2)}{n^2}$$

$$n^2 x^2 (1 + \tan \phi) + 2xrn^2 \tan \phi + n^2 r^2 = n^2 r^2 + 4nr^2 + 4r^2$$

$$n^2 x^2 \sec^2 \phi + 2xrn^2 \tan \phi - 4r^2(n + 1) = 0$$

$$x = \frac{-2rn^2 \tan \phi \pm \sqrt{4n^4 r^2 \tan^2 \phi + 16n^2 r^2 \sec^2 \phi (n+1)}}{2n^2 \sec^2 \phi}$$

$$= \frac{-2n^2 r \frac{\sin \phi}{\cos \phi} \pm \frac{2n^2 r}{\cos \phi} \sqrt{\sin^2 \phi + \frac{4}{n^2}(n+1)}}{\frac{2n^2}{\cos^2 \phi}}$$

$$= -r \sin \phi \cos \phi \pm r \cos \phi \sqrt{\sin^2 \phi + \frac{4}{n^2}(n+1)}.$$

$$L_p = \frac{x}{\cos \phi}$$

$$= r\left(-\sin \phi \pm \sqrt{\sin^2 \phi + \frac{4}{n^2}(n+1)}\right).$$

$$P_c = \frac{2\pi r}{n}.$$

$$P_c \cos \phi = \frac{2\pi r \cos \phi}{n}.$$

$$M_p = \frac{L_p}{P_c \cos \phi},$$

$$= \frac{nr}{2\pi r \cos \phi}\left(-\sin \phi \pm \sqrt{\sin^2 \phi + \frac{4}{n^2}(n+1)}\right). \quad (1)$$

$$2\pi M_p \cos \phi + n \sin \phi = \pm n \sqrt{\sin^2 \phi + \frac{4}{n^2}(n+1)},$$

Squaring,

$$4\pi^2 M_p^2 \cos^2 \phi + 4\pi M_p n \sin \phi \cos \phi + n^2 \sin^2 \phi = n^2 \sin^2 \phi + 4n + 4,$$

$$\pi^2 M_p^2 \cos^2 \phi + \pi M_p n \sin \phi \cos \phi - (n + 1) = 0,$$

$$n = \frac{1 - \pi^2 M_p^2 \cos^2 \phi}{\pi M_p \sin \phi \cos \phi - 1}. \quad (1a)$$

When $\frac{1}{n} = 0$ (rack), $\pi M_p \sin \phi \cos \phi - 1 = 0$,

and M_p becomes, $M_r = \frac{1}{\pi \sin \phi \cos \phi}$. (1b)

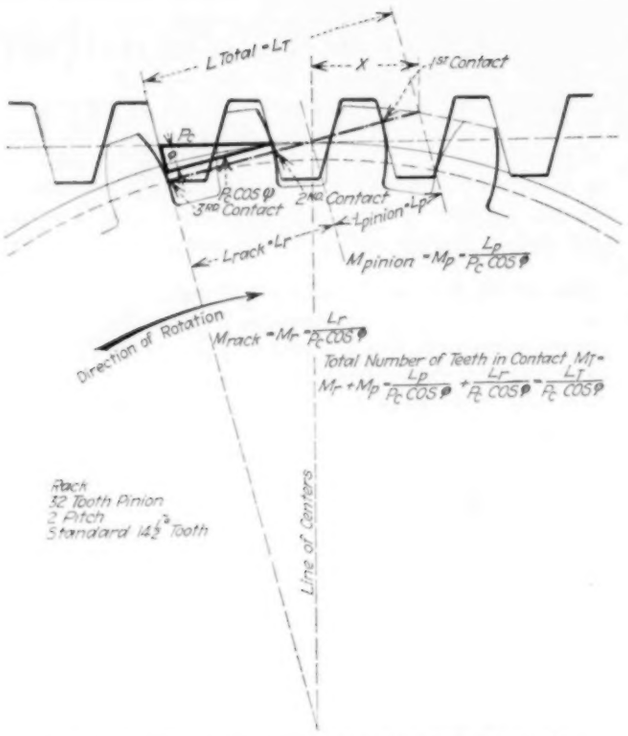

L Total = LT
X
1st Contact
Pc
Pc COS φ
3rd Contact
2nd Contact
Lpinion = Lp
Lrack = Lr
Mpinion = Mp = Lp / Pc COS φ
Direction of Rotation
Mrack = Mr = Lr / Pc COS φ
Total Number of Teeth in Contact Mt =
Mr + Mp = Lp / Pc COS φ + Lr / Pc COS φ = LT / Pc COS φ
Rack
32 Tooth Pinion
2 Pitch
Standard 14½° Tooth
Line of Centers

FIG. 1. REFERENCE DRAWING FOR DERIVATION OF FORMULA

Using (1a) as the form of equation most convenient for plotting, values of M for the 14½-deg. standard tooth were plotted against values of n, in Fig. 2. The curves in Fig. 3 are easily obtained from Fig. 2 for any ratio of gears by adding the number of teeth in contact M_p on the pinion side of the line of centers to the number of teeth in contact M_g on the gear side of the line of centers, thus getting the total number of teeth in contact for that particular ratio and number of teeth. For example, with a 1 to 2 ratio of gears M_p for a 50-tooth pinion is 1.075; M_g for the gear which has, of course, 100 teeth is 1.175. The total number of teeth in contact for this particular ratio and numbers of teeth is therefore 2.250. This number indicates that there will always be two teeth in contact and that one-fourth of the time a third tooth will be in contact and sharing the load. Those portions of the curves in Fig. 3 to the left of the dot and dash line cannot be used on account of tooth interference. (See *American Machinist*, Vol. 53, page 707.)

The formula for number of teeth in contact on internal gears is found by a method exactly similar to the above to be

$$N = \frac{\pi^2 M_g^2 \cos^2 \phi - 1}{\pi M_g \sin \phi \cos \phi - 1} \qquad (1c)$$

The 1 to 1 ratio of internal gears of course has no meaning except as showing the theoretical limit of number of teeth in contact as the gear ratio approaches unity.

Now, if for the sake of clearness we suppose a pair of heavily loaded gears made of very elastic material, such as soft India rubber, it will easily be seen that when the load is carried by only two teeth these teeth will be bent back, but that when the third tooth begins to make contact they will immediately spring forward on account of the lessened load each has to carry. This means a continual vibration. Suppose we choose from Fig. 3 such a number of teeth for the pinion that the total number of teeth in contact is a whole number. For example, two gears with 35 and 35 teeth are shown to have a total of two teeth in contact. A sketch, Fig. 4, of this condition has been made. From this sketch it is seen that just at the time the third tooth is making contact the first tooth is leaving contact, so that the load is carried on two teeth only—no more and no less at any position of the gears relative to each other.

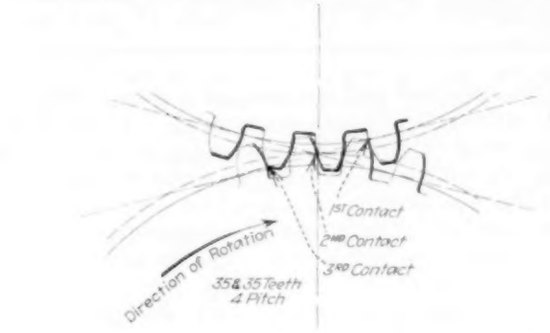


FIG. 4. GEARS WITH TOTAL NUMBER OF TEETH IN CONTACT = 2

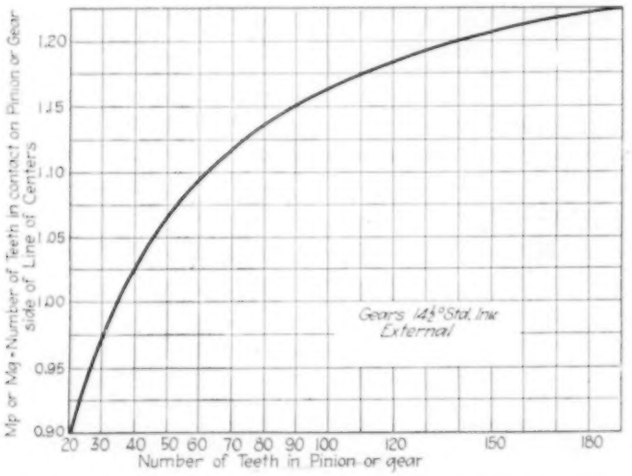

Mp or Mg = Number of Teeth in contact on Pinion or Gear side of Line of Centers
1.20
1.15
1.10
1.05
1.00
0.95
0.90
20 30 40 50 60 70 80 90 100 120 150 180
Number of Teeth in Pinion or gear
Gears 14½° Std. Inv. External

FIG. 2. RELATION BETWEEN NUMBER OF TEETH IN PINION OR GEAR AND M_p OR M_g

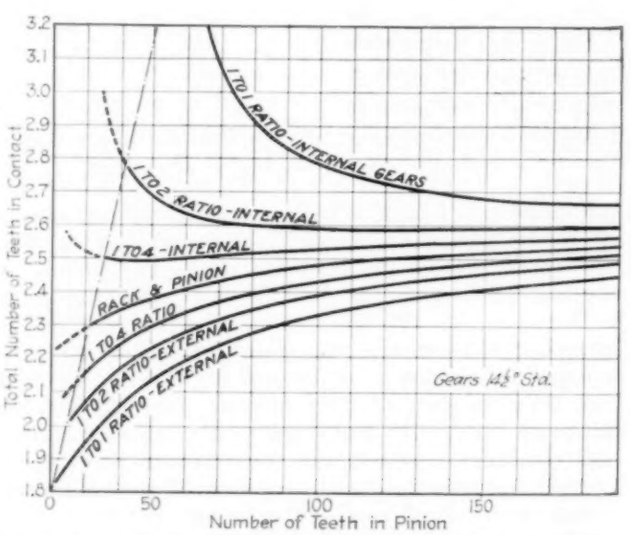


FIG. 3. NUMBER OF TEETH IN CONTACT FOR GIVEN RATIOS, 14½-DEG. STANDARD

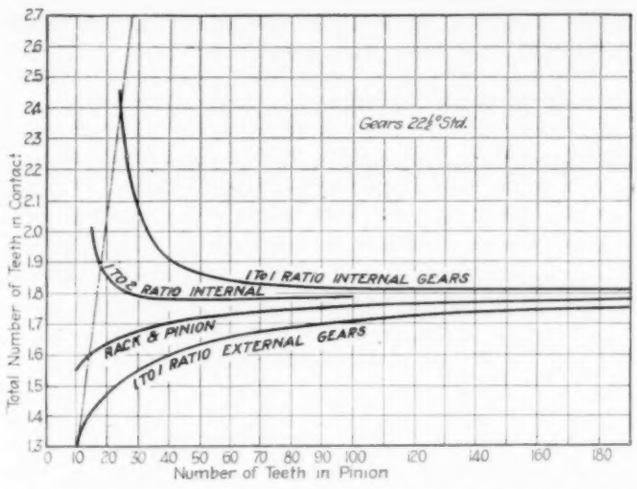

Gears 22½° Std.
1 TO 2 RATIO INTERNAL
1 TO 1 RATIO INTERNAL GEARS
RACK & PINION
1 TO 1 RATIO EXTERNAL GEARS
Total Number of Teeth in Contact
Number of Teeth in Pinion

FIG. 5. NUMBER OF TEETH IN CONTACT FOR GIVEN RATIOS, 22½-DEG. STANDARD

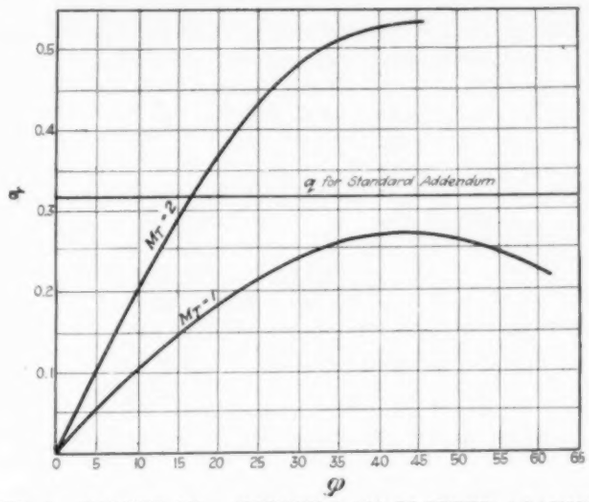


FIG. 9. VALUES OF q, FORMULA (4) PLOTTED AGAINST VALUES OF ϕ

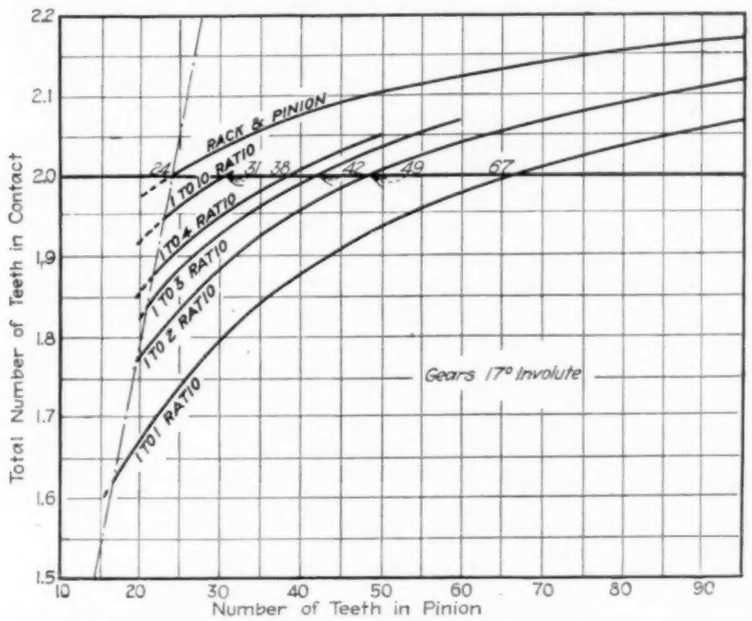


FIG. 6. NUMBER OF TEETH IN CONTACT FOR GIVEN RATIOS, 17-DEG. TOOTH

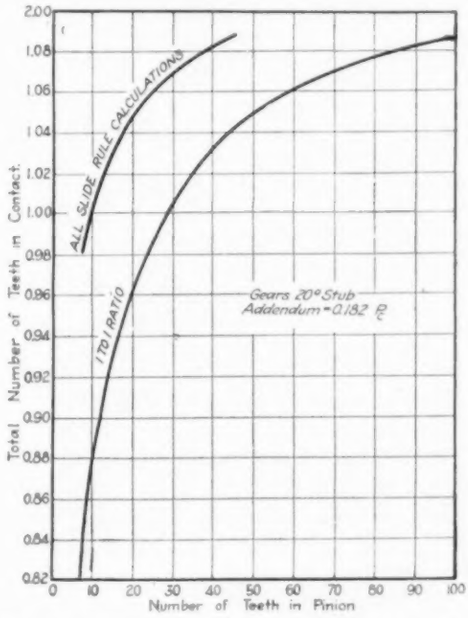

ALL SLIDE RULE CALCULATIONS
1 TO 1 RATIO
Gears 20° Stub
Addendum = 0.182 Pc
Total Number of Teeth in Contact
Number of Teeth in Pinion

FIG. 7. NUMBER OF TEETH IN CONTACT, 20-DEG. STUB-TOOTH GEARS, ADDENDUM = 0.182 P_c

It is evident that the 14½-deg. standard tooth does not lend itself to this design, and from Fig. 5 it is seen that the 22½-deg. standard is no better. In Fig. 6 are shown tooth contact curves for 17-deg. standard involute gears. It is seen at once that two teeth in contact can be obtained for any ratio of external gears by simply choosing the proper numbers of teeth for pinion and gear. For a 1 to 2 ratio the pinion should have 49 teeth and the gear, of course, 98 teeth, this regardless of the center distance, or pitch.

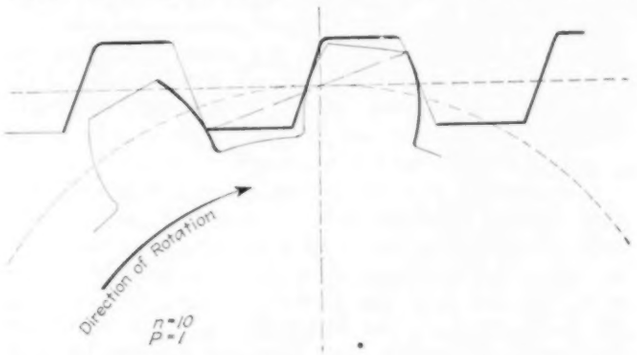


FIG. 8. RACK AND PINION, 20-DEG. STUB-TOOTH GEARS, ADDENDUM = 0.182 P_c

For those who want only one tooth in contact, no matter what degree of involute is chosen, this condition cannot be obtained with the standard length of tooth. It can be obtained, however, in the following manner.

The formula for non-interference of gears (see *American Machinist*, Vol. 53, page 707) was derived for standard-length teeth. If, now, the addendum be expressed as a fraction "q" of the circular pitch the interference formula takes the form

$$K = \frac{4\pi q n - 2n^2 \sin^2\phi}{n^2 \sin^2\phi - 4\pi^2 q^2}. \qquad (2)$$

For the condition of rack and pinion $K = 0$ and (2) reduces to

$$n = \frac{2\pi q}{\sin^2\phi}. \qquad (2a)$$

The formula (1a) becomes

$$n = \frac{\pi q^2 - \pi M_n^2 \cos^2\phi}{M_p \sin\phi \cos\phi - q}, \qquad (3a)$$

which is the general formula for the number of teeth in contact with gear teeth of any length. As before,

when $\frac{1}{n} = 0$ (rack),

$$M_r = \frac{q}{\sin \phi \cos \phi}. \qquad (3b)$$

Combining (2a) and (3a),

$$\frac{2\pi q}{\sin^2 \phi} = \frac{\pi q^2 - \pi M_p^2 \cos^2 \phi}{M_p \sin \phi \cos \phi - q};$$

Clearing,

$$2\pi M_p q \sin \phi \cos \phi - 2\pi q^2 = \pi q^2 \sin^2 \phi - \pi M_p^2 \sin^2 \phi \cos^2 \phi,$$

$$M_p^2 \sin^2 \phi \cos^2 \phi + 2M_p q \sin \phi \cos \phi - (2q^2 + q^2 \sin^2 \phi) = 0,$$

$$M_p = \frac{-2q \sin \phi \cos \phi}{2 \sin^2 \phi \cos^2 \phi} \pm \frac{\sqrt{4q^2 \sin^2 \phi \cos^2 \phi + 4 \sin^2 \phi \cos^2 \phi (2q^2 + q^2 \sin^2 \phi)}}{2 \sin^2 \phi \cos^2 \phi},$$

$$= \frac{-q \pm q\sqrt{3 + \sin^2 \phi}}{\sin \phi \cos \phi}.$$

$$M_T = M_r + M_p,$$

$$= \frac{q}{\sin \phi \cos \phi} - \frac{q}{\sin \phi \cos \phi} \pm \frac{q\sqrt{3 + \sin^2 \phi}}{\sin \phi \cos \phi}.$$

$$q = \frac{M_T \sin \phi \cos \phi}{\sqrt{\sin^2 \phi + 3}}. \qquad (4)$$

When $M_T = 1$,

$$q = \frac{\sin \phi \cos \phi}{\sqrt{\sin^2 \phi + 3}}. \qquad (4a)$$

For 20-deg. stub tooth gears "q" works out to be approximately 0.182. The tooth contact curves for this value of q and a 20-deg. involute are shown in Fig. 7. Fig. 8 shows a rack and pinion and the appearance of the teeth.

In Fig. 9 the value of q in formula (4) has been plotted against values of ø. In order to afford a comparison Fig. 10 has been drawn showing 10-deg. teeth with addendum equal to one-tenth of the circular pitch.

In conclusion it would seem that standard gears have a length of addendum which has the following disadvantages:

(a) Reduces efficiency and increases wear by extending the arc of approach and recess. (It is assumed to be well known that the slipping of the teeth of the gear on those of the pinion is greatest at these extreme points and increases very rapidly with increase of angle of approach and recess.)

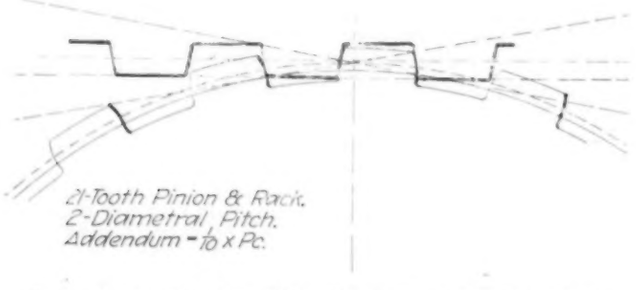


FIG. 10. RACK AND PINION, 10-DEG. TEETH, WITH ADDENDUM = 0.10 P_c

(b) Weakens the teeth by giving a longer leverage for the driving force to act on the teeth.

(c) Causes vibration, periodically causing the number of teeth in contact to vary.

What Is the Most Satisfactory Length of Work Day?

BY E. F. CREAGER

In these days manufacturers are wondering how they can so arrange the schedule of working hours as to meet prices quoted by competitors, satisfy working forces, and get the best efforts of employees as well as the fullest production from machine tools.

We hear the six-hour day, with a lunch period of not less than one hour, advocated by one branch of workmen; the six-hour day, five-day week (some say four days), by the miners, and much other propaganda along the same lines; but I have seen no real analysis made.

Every thinking manager knows that conditions were changed by the war to an extent that precludes the possibility of the present generation seeing a return to the pre-war basis; and I do not believe that there are many who really desire to see it.

One good result brought about by the present competition for help is the greater consideration given to employees. Better light, cleaner shops, more intelligent study and application of safety appliances, better sanitation, lunch rooms, rest rooms, surgical and medical attention, and many other improvements have been introduced in an effort to render their working environment more attractive.

Now what is the most satisfactory working shift and the best lunch hour period considering, of course, both the men and women employees? We have heard it said many times that "you can get out as much work in nine hours as you do now in ten, if you make the change." What is the actual experience of the readers of *American Machinist* relative to this question?

DRUG-STORE HOURS

The writer began his working life in the drug business; opened the store at 6 a.m. and closed it at 9 p.m. with Sunday hours and the privilege of Wednesday evening and every other Sunday off. Since that time in various professions he has seen the gradual shortening of working hours; always with the statement that "just as much work can be done" in the shorter period.

The general manager of a large American factory told me that he knew of an English manufacturer who had "by intensive methods reduced his working hours from eleven to six with a slight increase in total production."——Yes, I thought the same thing you are thinking; but he was my boss at the time and I did not care to tell him so. And then he located the manufacturer in England, and England was at war at the time and no passenger boats were running.

I have heard men rant about the nine-hour day; how they had no time for rest or recreation and no time with their family; yet I have known these same men to leave the nine-hour shop working fifty hours per week for one with the eight-hour basic day, working ten hours regularly and five nights until ten o'clock and nine hours on Sunday, with time and one-half for overtime and double time for Sundays and holidays. Did they weep over being away from the bosom of their

families? Not on your life. They told you proudly that they had "pulled down *ninety-two* bones last pay."

I believe that Saturday afternoon as a working period is a thing of the past, except for rolling mills, furnaces, etc., and also believe that the majority of the working people really prefer the nine-hour day at a reasonsable rate, to the eight-hour day at the same hourly rate. I also believe that as much work can be produced in nine hours in a well-organized factory as is now being produced in the average factory in ten hours.

In the reorganization of a large plant in the Middle West, one of the first changes made was the reduction from fifty-six hours to fifty hours per week, and while it was impossible to get exact figures on the results, a large increase of production was shown and more contented workers of a better grade were noted. This plant, however, was in such shape at that time that almost any change would be for the better.

Some years later, under a different management, a new system of hours and shifts was proposed. A committee of factory executives was appointed to consider and report the scheme, and, though they were unanimous in their adverse opinion, the plan was ordered put into practice. It consisted of two 8-hour shifts, one beginning at 6:45 a.m. and working through till 2:45 p.m.; the second beginning at 3 p.m. and ending at 11 p.m. for the men, and 10 p.m. for the women.

A Short Lunch Period

In each shift fifteen minutes was allowed for the eating of such lunch as the employees brought with them—this lunch to be eaten at a certain time for all, and at their place of work; either bench or machine. No deduction was made from the employees' pay for this time.

Those who desired to do so could take one hour, no less, for lunch. This hour was deducted from their pay and they were compelled to leave the factory for the full period. While not so posted, it was generally understood that those who took this hour for lunch would shortly take a much longer time in the shape of a "permanent vacation."

The advantages claimed by the management for the scheme and the employees were: 1. 50 hours earning in 48 hours of work. 2. Additional time of liberty without interruption of the regular sleeping period, since the plan does not contemplate night work after 11 p.m. 3. Greater period of daylight, rest and recreation. 4. Greater opportunity for outdoor games and exercise. 5. Opportunity to work around the home. 6. More time to spend with the family. 7. Daylight marketing and shopping for both shifts.

You will note that items two to seven say the same thing in different ways. The executive who wrote the above was a member of the committee who reported against the proposed plan and who became a victim of the house-cleaning incident to its failure. The advantages to the factory as claimed by the management were: 1. Increased or double production possible on same machine-tool equipment. 2. Decrease of overhead owing to double production on same equipment. Actual working of the shifts and hours brought up the following points for and against it: Owing to the state laws governing the working of females after ten p.m., they were dismissed at that hour. They were paid for the full time, so that their earnings were equal for the two shifts. This earlier dismissal possessed the apparant advantage of allowing them to get home an hour earlier than the men, but since many of them had male members of the family working there, or else came to work from distant points in automobiles in groups, most of them waited either through choice or necessity until the men were dismissed. The shifts changed every two weeks, the day force becoming the night force; this meant an entire rearrangement of the habits and hours of the employee at each change.

From the younger employees, when on the night shift, came the objection that they could not go to the "movies" or to see their girls. Those of maturer years who had homes near enough to the factory to get home for lunch in the usual one hour period and had become more or less settled in their habits, complained that they could not get their stomachs to conform to the changing hours for food, and they also objected to "cold lunches."

The disruption of family habits was another point raised. Say the head of the family was working under these conditions, another member of the family was working under normal conditions, and there were children of school age; can not you who are men of family easily imagine what the wife's opinion of these hours would be?

The change of all rates to compensate for the two hours less per week for the day workers together with the smaller production increased the cost of the articles made. Salaried employees receiving the same pay as for the longer week constituted an additional expense not in any way compensated for. Records of the production of the late shift never showed more than the usual rate of "night work."

Transportation a Cause of Complaint

Difficulties of transportation was another cause for contention. Employees were drawn from a radius of twenty miles, and while there was but little objection or trouble in the summer time there was considerable trouble during the winter months, particularly where employees dismissed at 11 p.m. missed or were delayed by the trolley service.

The system required double the amount of supervision and inspection force and there was a continual "passing of the buck" from one shift to the other. These latter points would of course apply to any form of double shift.

An unexpected result of the "short hour" day was disclosed when the company had some special rush work to be done and the carpenters and plumbers or steam fitters were needed for extra time. They said they could not come as they could not get away from their other jobs, and an investigation showed that all of the carpenters and most of the steam fitters as well as a number of other employees were "holding down" other jobs.

Fifty hours' production in forty-eight hours was attained by the piece workers only. The day workers gave forty-eight hours' production and no more. Observation did not show that they went to work one minute earlier or worked one minute longer, one stroke faster, or any harder than they did before.

After eight and one-half months the double shift was discontinued with the usual loss of employees and all the difficulties incident to such changes. They are now working a nine and one-half-hour day and a fifty-five-hour week with one-half hour for lunch. The machinists and toolmakers recently protested the nine and one-half-hour day and petitioned for an eight-hour day with time

and one-half for over time, which was allowed. Since then a lunch period of one hour has also been allowed. This is the history of one radical change of shifts which was a failure. The experience gained from it shows that the eight-hour work day was not considered an economical one. Recently the manufacturers of Indianapolis, after having worked an eight-hour day for some time, decided to return to the nine-hour day.

We do not find much objection, where night gangs are a necessity, to their working ten to twelve hours provided they do not work Saturday night, but the proportion of men who will hire for night work is small and usually a premium or higher hourly rate is paid than is current for the same kind of work in the day time; the grade or quality of workmen is lower, the spoilage is greater, and the quantity and quality of work is less.

There is a correct speed and feed for every operation on a machine—"the critical speed"—is there not one for labor? You pay for labor. Are you getting your money's worth? What are you doing to find out? Do you know what constitutes a "good day's work"? Do you know your machine efficiency? Are you making any studies of the operator's efficiency that will enable you to rate him for what he is worth?

In one instance, by a time study of the operators' efficiency, the number of operatives was reduced thirty per cent and more work was produced. The remaining operators were paid in proportion to their per cent of efficiency, and they were satisfied to put out the extra work. I do not think there is thought enough being given to time study, particularly as applied to the employee.

In some cases studies have been made and the efficiency is known, but the operative is still receiving the base rate for that class of work. We should find out what is possible for a "first-class" worker, train him to do a "first-class" day's work, divide the increased profits with him, treat him as a "first-class" worker, and save money on the pay roll.

Production of Boiler Flue Beading Tools in Railway Tool Shops

By J. V. Hunter

Most railway tool shops have found that the boiler tube beading tools made for use in the pneumatic hammers of the boiler repair shops are expensive to maintain. They have to be carefully made and it almost seems as though some inspectors required a needless degree of accuracy in the shape and finish of the working portion of these tools. A gage used for checking the shape of the working end of such a tool is shown in Fig. 1.

The beading-tool forging shown in the same illustration was made in a forging machine and it will be noted that the forging operations have both formed the beading end and necked down the shank to reduce

FIG. 1. FORGED BOILER FLUE BEADING TOOL AND GAGE

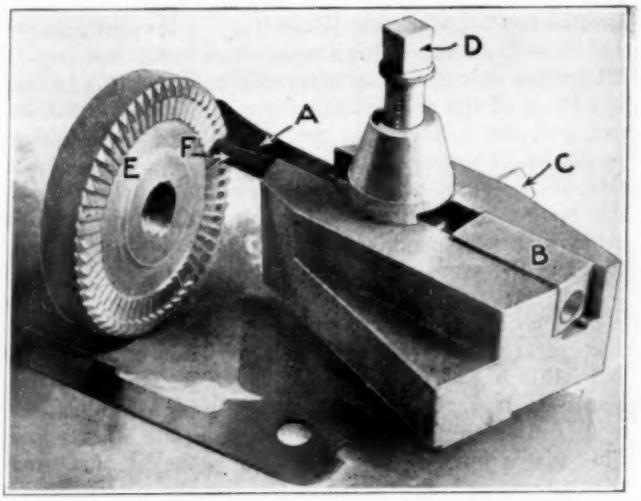


FIG. 2. TOOLS FOR FIRST MILLING OPERATION

the amount of stock to be removed in the subsequent finishing operation. The finish on the working end of these forgings is usually by filing and as this must both fit the gage and at the same time have its edges carefully rounded the rate of production is only about four per hour.

The tools shown in Figs. 2 and 3 were exhibited by W. H. Casson at the annual convention of the American Railway Tool Foremen's Association and represent the method employed in his shop for finishing them.

The method requires only a lathe for the machining operation and the models are photographed in the relative position that they will occupy when set up on the machine. The rough-forged beading tool *A*, Fig. 2, is held in a special tool block on the lathe carriage, and its previously turned shank is carried in the block *B* held by the setscrew *C*; the whole being held down by the screw *D*. The milling cutter *E* is threaded to screw on the nose of the lathe spindle and is knurled on the periphery to facilitate its removal. This cutter roughs out the notch for the bead and finishes off the heel of the tool at *F*.

The second operation is performed by the hollow milling cutter *A*, Fig. 3, which screws on the spindle nose of the lathe. This mill is made with removable cutter blades of high-speed steel that are ground on their cutting face to a contour to match the portion *B*, Fig. 1, of the gage. The small inside diameter of this hollow mill produces the required radius heretofore obtained by the slower process of filing. The round nose on the tips of the blades finishes the notch *B* next to the heel of the tool. Very little hand filing is required to complete the work.

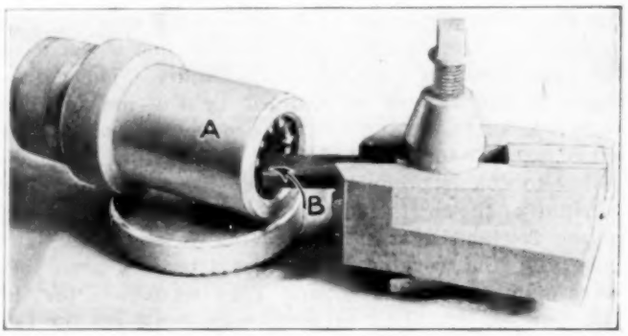


FIG. 3. HOLLOW MILL FOR FINISHING OPERATION

False Starters

By J. D. HACKETT

The narrow viewpoint still existent in some plants, that the duty of the employment office ends immediately when the applicant is hired, is undoubtedly responsible for much labor turnover. This becomes apparent when a study is made of some facts seldom referred to by the employment manager and altogether unsuspected by the "man higher up."

THE "False Starter" is one who has been tested, selected and approved by the employment department but has failed to get on the job. The false starter is, of course, nothing new in industry but, as yet, his mode and kind have hardly been observed, much less considered. In some plants his existence is still unsuspected; in other places he is a recognized nuisance, while in a select few places active steps are being taken for his elimination.

In one of the Youngstown steel mills in 1916, it was found that out of 16,326 men hired, 1,118 or 6.85 per cent, failed to get on the job although they had gone through the same procedure as all the others. During the war there was a great increase of "shoppers" who, after being selected, took a sharp observant look around the plant and left without a trace. In a munition plant during 1918, where 14,841 were hired, 2,521 or 17 per cent failed to start at a time when the need for production was particularly acute. But this loss still continues. In a New York plant during 1919 where many young women are employed, the "false starters" amounted to 12 per cent of the total hired and the figures this year show averages as high as 20 per cent for single months.

These figures prove that much of present employment work is thereby wasted effort, and, until some constructive measures are adopted, the loss is going to continue. Solution of the problem presents some special difficulties because the applicant will continue to fade away without giving anyone an opportunity of knowing the real, specific, immediate cause. Even were such facts ascertainable they would only disclose indirect or remote approaches to a remedy.

Causes that Help to Make False Starters

The discoverable causes may be sought in the employment office or in the plant itself. The primary causes are few and apparent, the secondary causes are many and subtle. As long as the labor market is "short" the difficulty of the "shopper" and consequently of the "false starter" will remain to some degree.

Intrinsically the secondary causes are difficult to ascertain. They lie wholly with the applicant, the employment office or with the foreman, apart from the conditions of employment or the plant itself. These contributory causes may not be removable readily but they can be mitigated if they are clearly recognized. The remedy is usually within the sphere of influence of the employment manager since he is in a position to influence the attitude of his assistants and of the foremen and, often, their education in man handling, which is an important factor.

The applicant, if he be a "shopper," is waiting to be persuaded that the place is as good as can be found and it is here that the employment office generally fails. The interviewer seldom rises to the occasion, with the result that little real effort is put into the task of "selling" the job. The applicant has usually some preconceived and unfavorable notions about the plant that can easily be dispelled if the interviewer goes to the trouble of ascertaining what they are.

Applicants Want to Know About Employers

Not so long ago it was the exclusive privilege of the employer to ascertain all he could about the applicant. We have now arrived at the period when the applicant requires to know something about the employer. Unless his curiosity is satisfied, he will join the ranks of the false starters.

The fact is that the hitherto shadowy "wage contract" is now showing a distinct tendency to become less of a one-sided affair than ever. It is a good thing for both the applicant and the employer because, when conditions are more clearly understood, there will be fewer false starters and considerably less turnover.

Not many interviewers have thought out the technique of their jobs sufficiently to discover that there are two distinct phases in the interview; the first, in which he concentrates upon the discovery of reasons for rejection, and the second, in which he seeks valid cause for selection. The object of the former is to eliminate the unsuitable at the earliest possible moment; the idea in the latter is just the opposite. It requires a certain amount of "nerve," under present conditions, to adopt this attitude but it avoids loss of time on both sides and saves the credit of the employment department in the shops. A sensible interviewer must satisfy himself that the contract is mutually beneficial, otherwise it will not be permanent or successful. If, for instance, the applicant lives an hour's ride away from the plant and has to pay two or three fares, he will not take up work unless compensating circumstances exist and are carefully pointed out. The interviewer has a job to sell, the applicant has a job to buy and the former wins if he is a good salesman. Unless, however, wisdom has been shown in placement and the bargain proves to be good to the buyer the sale will not be permanent.

Courage Lost by Needless Delay

It is a mistaken notion that, because a man is out of a job, he has plenty of time to waste. One is easily deceived by the apparently placid appearance of the applicant, but it is all on the surface. Within there may be a burning desire to get any kind of work but this feeling is disguised because it might interfere with the applicant's prospects. Prolonged waiting often sours the applicant who, illogically enough, loses courage just at the time when his ambition is about to be realized. There might be some excuse for delay in the employment office if there was an effort to make the applicant comfortable in the waiting room, but, the contrary is often the case and the applicant is thus thrown back on his own melancholy reflections, which are bound to react on his attitute toward the prospective work. Then, when the time comes for taking the job he disappears.

Another contributory cause is in the casual treatment applicants usually receive from the interviewer. The job is indefinite, the wages are indefinite and the other conditions, which may be of interest, are not even mentioned. The incipient worker is given a few incoherent, verbal directions as to where to go, whom to see and when to start. He knows, from previous experience, unless he is a "floater" who enjoys such adventures, that the first day's work at any job is the hardest because it is filled with doubts and perplexities which no one seeks to relieve.

Whether rational or otherwise some applicants dislike physical examinations, particularly as no effort is made to point out the possible benefit of such a procedure to them. The brusk and bustling nurse is absorbed in her own duties and has no interest in the troubled mind of the applicant, and so he is gradually acquiring a case of "cold feet," unrecognized in the medical department as a symptom particularly dangerous for the future job.

Even after the whole procedure has been accomplished some simple fact as yet unexplained may cause the applicant to decide that the job is not for him. Besides, he has yet to make the acquaintance of the plant, the foreman and the actual working place where he will be expected to spend much of his waking hours for the future. The connecting link between the employment office and the working place is generally very weak if it exists at all. The worker who would like to be on the payroll is stumbling round the yard without knowing exactly where to go. Since the above are only a few of the contributory causes it will be understood that the remedy for "false starters" must be comprehensive.

Primarily there must be a full realization of the existence and size of the loss through carefully gathered statistics. These will often indicate some obvious remedies but, one of the first things, not apparent from any statistical abstractions, is that the solution lies in the application of teamwork, salesmanship and common sense to the problem by all those who come in contact with the applicant. This means that there must be co-operation all along the line from the time the applicant enters the employment office until the moment when he is firmly planted at work. The interviewer, the connecting link between him and the foreman, and the foreman himself must all be alive to the situation and this is only attained by the education of each in the requirements of their respective duties toward the applicant.

A Chance for Study

Systematization of the interview is an important step provided it is designed to meet the issue. By this is meant not a careful holding to routine but a studied application of ordinary, common sense methods to the problem and the improvement of technique in the procedure. This may or may not involve a knowledge of human psychology, but it does involve careful organization. If false starters are to be eliminated this, at least, is essential.

The applicant's point of view regarding work and the plant must be ascertained. The possible advantages of the work to the applicant must be explained. Few employers, though they may have spent millions to advertise their wares to the public, will not consider spending a cent in advertising the plant to the prospective worker. In the mind of the applicant the plant may have a reputation to live down. It is the function of the interviewer to dissect his point of view.

An important feature is to establish a specific connecting link between the employment office and the job itself. This may involve the creation of a trained messenger service and a proper system of introduction whereby the applicant is continually kept in hand until he is put to work or provided with such literature and information as will make him want to return in case he does not start work immediately. In some plants a moving picture show, full of interest and information, is provided for such as are about to work. The pictures first show the sources of raw material, the small beginnings of the plant, the method of manufacture, the personnel, some safety lessons and health hints. Thus the monotony of waiting is relieved and the applicant is prepared for his future career.

When the Pay Should Commence

It is obviously a good plan to get the new man to work as soon as possible, but this is hardly essential if interest has been aroused. Earl B. Morgan, of the Curtis Publishing Co., writing recently upon this subject, finds it advisable to give the new employee a full day's pay for the first day if he starts work as soon as approved by the employment office. The cost is inconsiderable in comparison with its influence in sweetening up the new man's feelings. The percentage of false starters is found to increase progressively with the length of time which they have to wait before beginning work, but, even there Mr. Morgan has succeeded in having forty-nine girls report over Sunday out of a possible fifty-one and the two delinquents sent messages regretting their absence! That is a good performance and it is accomplished by means of a re-interview after the applicant has had a full opportunity of learning the best and the worst concerning the work about to be undertaken.

The general appearance of a plant is not unimportant by any means. Sloppy or dusty roads, a broken gate and a dirty exterior must convey an impression of disorder and unattractiveness within which cannot fail to affect the desire of the worker. If, on the other hand, the entrance has a well kept, prosperous look the inference is naturally drawn that it must contain prosperous employees. The employment manager will, therefore, do well to see that the condition of the entrance and its surroundings is kept as trim as possible. A little gardening adds much to appearances and such small details are not without their effect on the elimination of the false starter.

England Investigating Her Water-Power Resources

The British Government has begun an investigation into the water power resources of the United Kingdom to determine how far "white coal" may be relied upon to supplement the nation's coal resources. Through its English information service the Bankers Trust Co. of New York is advised that special committees appointed by the British Board of Trade and the Privy Council are at work on the investigation.

Furthermore, an official water-power resources committee has already examined and reported favorably upon nine separate schemes of water-power development in the Scottish Highlands. These nine schemes, it is estimated, would yield an aggregate of 183,500 hp. at a cost much below the present cost of generating power in Scotland by the use of coal.

Making a 52-In. Planer from a 36-In. Machine

By Donald A. Hampson

In most manufacturing machine shops, the planer work forms the basis, or foundation, for the product; frames, bases, slides, special fittings—all have to go on the planer first for machining the surfaces to which other parts are attached and fitted.

There is shown in Figs. 1 and 2 a planer that was put in without straining the factory's capital. A 52-in. planer was needed to keep the planer work up with the increasing orders as well as to keep down the cost of the work, which was all plain cutting of the kind where one man can easily attend to two or three machines.

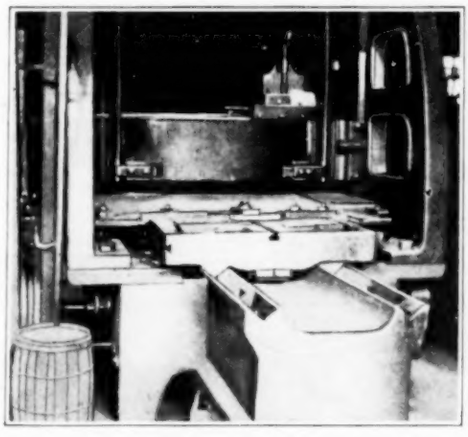


FIG. 1. REAR VIEW OF WIDENED PLANER

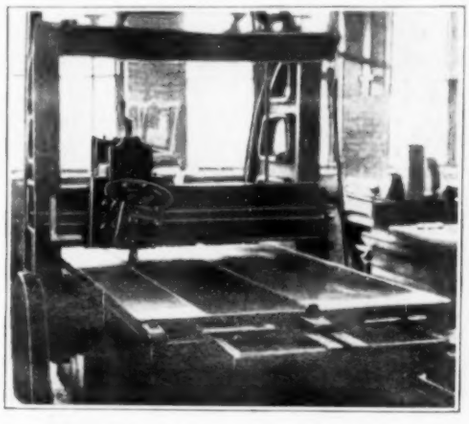


FIG. 2. FRONT VIEW OF WIDENED PLANER

A 30- and a 42-in. machine had been in the shop a long time but the great need was for a machine that would handle the 51-in. castings that came along, as well as the narrower ones made in larger quantities. A survey of the field showed that there were no used machines of this capacity with tables less than 14 ft. long—and the shop's work never ran over 7 ft. in length. The extra floor space, the excess of power required to move the big table, and the prices of nearly five figures put these machines out of the question.

After it had been decided to get along without another planer, a representative of the plant visited the warehouse of one of the "Searchlight" advertisers to get some milling machines. These had been inspected and the representative was being taken to the shipping door to see the dealer's railroad facilities, when he spied a planer off in a dark corner. "That's a 36-in. machine," said the warehouse man, "she's all shot though, no good for anything but stone work. You can buy that for $700 as she stands, but it's too small for your work." However, the representative took a good look and made some measurements. He did some hard thinking going over on the ferry to the office. The result was that he got the planer "thrown in" with his millers for $500—and another $140 put it on the floor in his plant.

A study of Fig. 1 will show how the machine was widened to 52 in. At the shop's hourly rate, it cost $260 to do this work, including the refitting and the putting in of new parts. Some parts of the machine *were* "shot"—parts to replace those were bought from the makers. Other parts, such as the V's, had plenty of metal in them for replaning. The new parts cost $265 delivered, and they included new gears and longer shafts. Thus for $1,165 a very satisfactory machine was delivered on the floor ready to belt up.

It will be noticed that the cross-rail elevating screws are several inches inside the uprights and also that the clamps for the rail are put inside of the housings instead of outside; likewise that the rail, which was extra long for a 36-in. machine, does not quite reach the outside of the uprights in their new setting, though long enough for 52 in. feed. All of these drawbacks were weighed against the service to be required of the planer and it was decided that they offered no serious hindrances and that it would be worth while to save the cost of altering to standard type. The work to be done on the machine never ran over 4 in. in height, making it rather special in character. Several months of service have justified the saving in alteration expense.

The widened planer had a table of the same width as the 42-in. machine already in the shop, so that the same work and fixtures go on without any changes. Its length of 7 ft. was admirably suited to the space and needs of the shop. For the widest castings planed brackets are used to support the overhanging ends and center. The forward brackets act also as posts, or stops. This machine and the 42-in. planer are operated by the same man. To save time and walking the planers face in opposite directions, so that both controls are near the operator.

Some one rises to remark that the best paying tools are the most modern ones (and these are the highest priced). This is generally true. But it is likewise true that many concerns run their businesses without any too much capital, when they come to pit it against present day prices, and they must buy, if at all, within their means. And again, there are jobs which may be tooled up or arranged so that older machines in multiple will do as much as the modern machine in standard practice—the man of limited means must use his wits to beat his pocketbook. And finally, it is a known fact that countless machining operations consist of cuts so light that the power of the most up-to-date machines cannot be more than half utilized; for such work the older tools will answer just as well if in good physical shape.

A Hob-Grinding Attachment

BY R. A. WILSON

The hob-grinding attachment here described was designed and built by the Autocar Co. for grinding hobs with helical flutes, but it can, of course, be used for grinding hobs with straight flutes.

The attachment is shown in Fig. 1 mounted on the table of a Cincinnati universal cutter and tool grinder. In Fig. 2, part *A* is the body of an indexing head that carries the center *D*, on which is mounted the dividing plate *E* and handle *F*. Keyed to *E* is the gear *G*. The casting *A* houses also the rack *H* meshing with gear *G* and giving the center *D* a rotary motion, which is in turn transmitted to the arbor *I* through the dog *J*.

Part *B* is an arm suitably mounted on the saddle of the machine and having a slot milled throughout its length, in which slides the block *K* fastened on the end of the rack *H*. The angle to which the arm *B* is set with the table determines the travel of the rack *H* and the angular movement of the gear *G*, the travel being zero when the arm is parallel with the table. *B* is bored to receive the stud *L* that is tapped into a boss in *C*, which, in turn, is bolted to the saddle of the grinding machine. The arm *B* can be locked in any position by the nut *M*.

To grind a hob, which is mounted on the mandrel *I* between centers, the arm *B* is set to the angle required to suit the helical angle of the flutes, the edge of *B* at the pivoted end being graduated in degrees to facilitate this. The indexing handle *F* is adjusted to the proper circle of holes on the indexing plate by loosening the nut *N*. It will be noticed that the handle is slotted and fits over flats on the end of center *D*. The handle *F* carries a spring plunger *O* which engages the holes in the dividing plate *E*. The stops on the table are next set to give the necessary travel, and the end

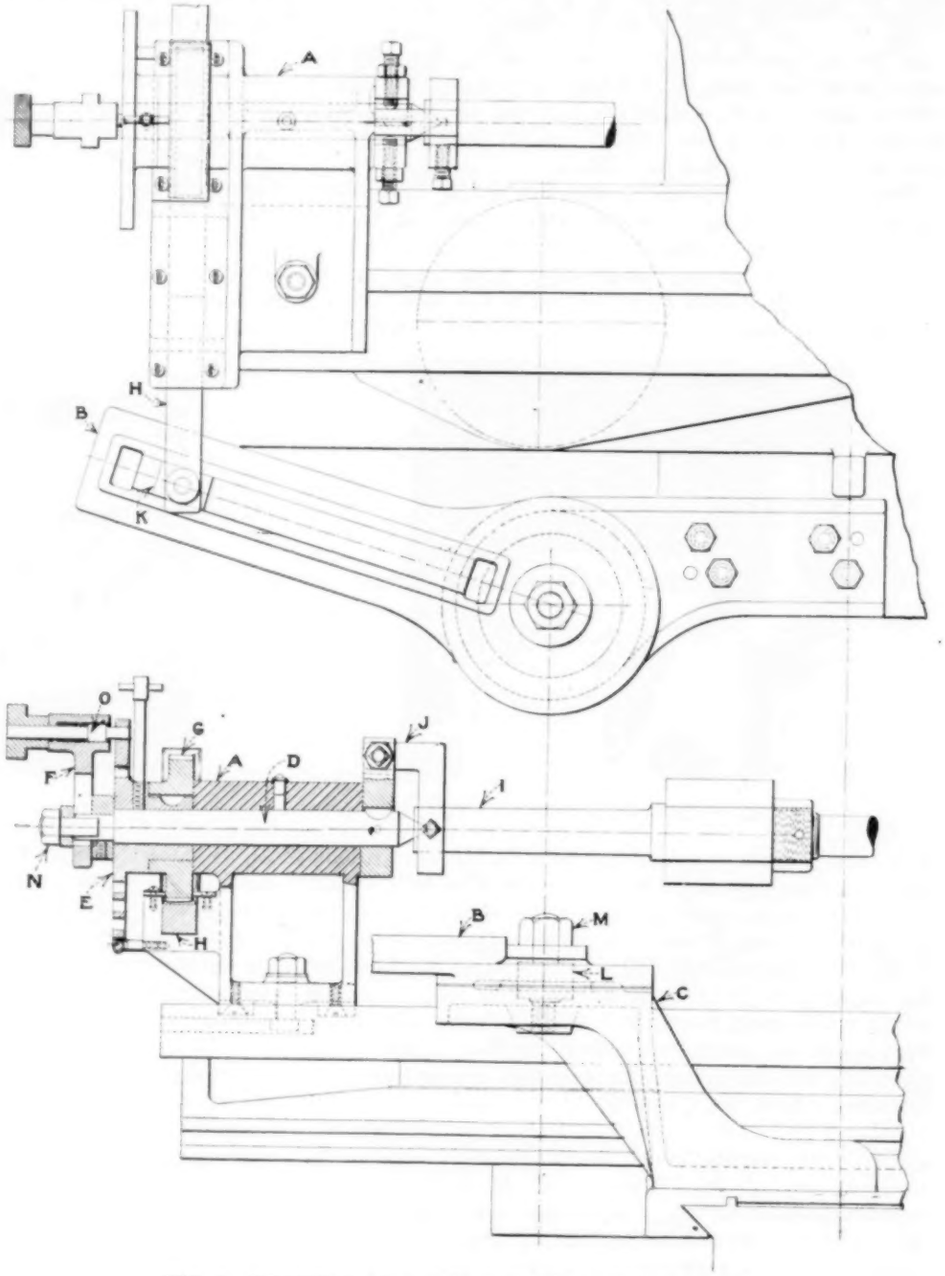


FIG. 2. DRAWING OF A HOB-GRINDING ATTACHMENT

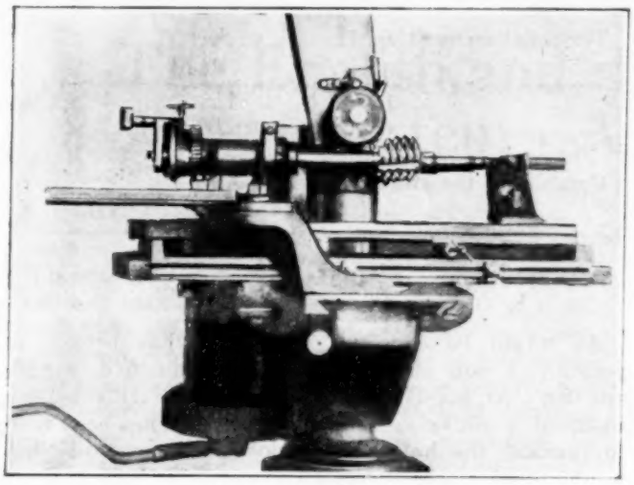


FIG. 1. HOB-GRINDING ATTACHMENT ON A CUTTER GRINDER

of the first flute is brought in line with the wheel. Rotation of the hob while grinding is automatic, as the reciprocating movement of the table causes the block *K* to slide in the slot of the fixed arm *B*, thus moving the rack back and forth and imparting a reciprocating motion to the gear *G*. The motion is transmitted through the indexing plate and handle to the hob. After grinding one flute, the hob is indexed by hand to the next, and the grinding continued.

Strength of Shafts and Beams

BY JOHN S. WATTS

The size of a shaft necessary to carry a given load, as a beam, with the load concentrated at the center and supported at both ends in bearings, can be readily determined by the use of the chart, Fig. 1.

Knowing the load and the centers of the bearings, the size of shaft required can be read directly off the chart at the intersection of the diagonal line for the load with the vertical line for the centers of the bearings. Or, given any two of the three factors, size of shaft, load, and distance apart of bearings; the other can be determined at a glance.

For example, to find the diameter of shaft required to carry a load of 13,000 pounds with the bearings spaced 50 in. center to center. Following down the 13,000 diagonal line to its intersection with the 50 vertical line, we find from the next higher horizontal line that the diameter required is 6¾ in.

The chart may be used for any span beyond its range by remembering that the load a beam will carry varies inversely as the span, and therefore if the span is over 100 in., we may take one-tenth of the span and ten times the actual load, and the diameter given by the chart will be correct. It is not essential to take ten as the divisor; any other number will give the correct result, so long as we multiply the load by the same number by which we divide the span.

For instance, if the load was 10,000 lb. and the span 120 in., we could take 60 in. span on the chart and 20,000 lb. as the load, using a divisor of two in this case.

The formula used in making up the chart is, of course, the one for beams supported at each end and with the load concentrated at the center of the span and is:

$$W = \frac{4fz}{l}$$

Where W = load in pounds
f = stress in pounds per square inch
z = modulus of section = $\frac{\pi}{32} d^3$
d = diameter of shaft in inches
l = length in inches, center to center of bearings.

The load on the shaft given by the chart is the total load, and when the distance between the bearings is great the weight of the shaft itself should be deducted from this load to arrive at the net safe load. But in the average case the weight of the shaft may be neglected.

The stress used in making up the chart is 6,600 pounds per square inch. This may seem to some a very low stress, but the writer's experience has proved that a higher stress will sooner or later cause a fracture of the shaft, and instances of such breakages will be given as proof further on. It should be remarked in considering the stress that can be allowed on a shaft carrying the pull due to belt pulley or a rope sheave, that the stress is rapidly alternating between the maximum in compression and the maximum in tension, because each half revolution of the shaft changes the stress in the outer part of the shaft from the maximum tensile stress to the maximum compressive stress. With a shaft running at say 200 r.p.m., this will mean 200 × 60 × 10 = 120,000 alternation or reversals of stress per ten-hour day. The writer, some years ago, had knowledge of a

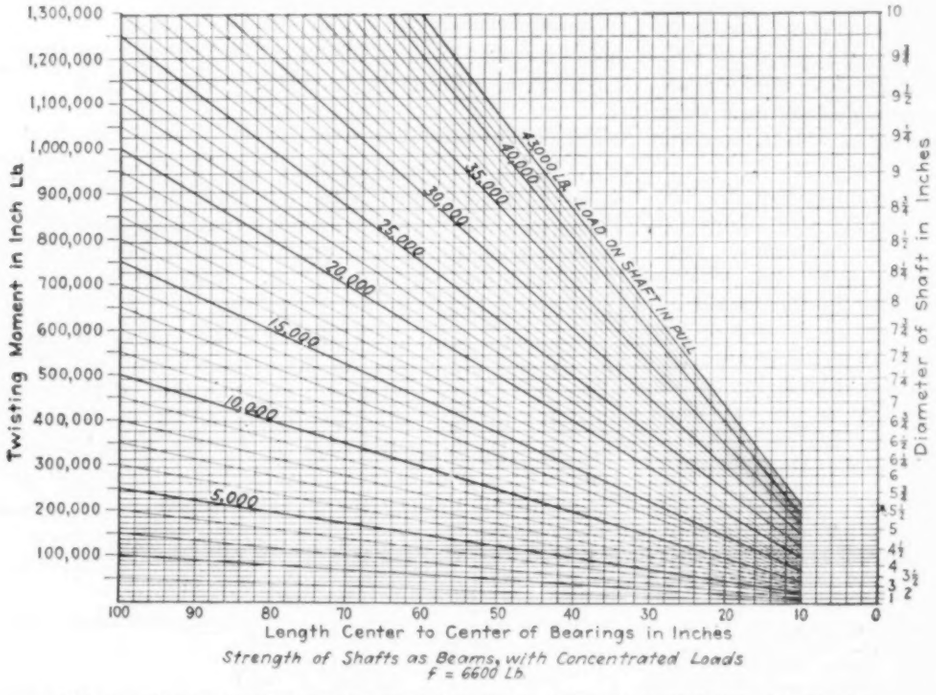


FIG. 1. CHART SHOWING STRENGTHS OF SHAFTS CONSIDERED AS BEAMS

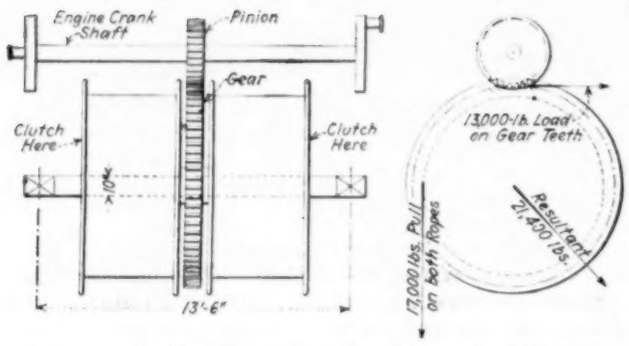


FIG. 2. ARRANGEMENT OF BEARINGS AND GEAR ON SHAFT THAT BROKE

case of a mine haulage machine in which a shaft carrying the rope pulley, and not subject to any torsional stress, but only the bending stress due to the pull of the rope, was originally made 10 in. in diameter. Owing to the lengthening of the slope and gradual increase in the output of the mine, the load ultimately became too much for the shaft, and it broke.

Calculation showed that the stress on the shaft due to the pull on the rope was about 14,400 lb. per sq.in. It was decided to increase the shaft to 11½ in. diameter, which reduced the stress to around 9,500 lb. per sq.in., but this new shaft only stood for about six months when it also fractured, although the load had not been increased during that time.

The owners were not convinced that the stress was too high and blamed the quality of the steel in the shaft, but analysis and tests showed that the shaft was of a good average quality of steel. Finally another shaft was made 12 in. in dia., thus further reducing the stress to 8,400 lb. This shaft stood up to the work for about a year, when it too broke, and this time was replaced by a shaft 13 in. in diameter, which gives a stress of 6,600 lb. per sq. in. This last shaft has now been in commission some seven years and shows no sign of distress.

Another case that came to my knowledge was that of a hoisting engine. The main shaft was 10 in. in diameter and carried two drums, being driven by a gear in the center.

The drums were loose on the shaft and were driven by clutches on the outer or bearing sides of the drums, so that the shaft was under torsional as well as bending strain.

The general arrangement is as shown in Fig. 2. The pull on the rope hauling up the full cars was 13,000 lb., and on the other rope, letting down the empties, was 4,000 lb., making a total pull of 17,000 lb., pulling horizontally on the shaft, practically in the center of its span when both ropes were at the inner side of the drums. The pressure on the gear teeth would be that due to the loaded cars coming up, namely 13,000 lb., acting vertically downward, and the resultant of the two loads works out to 21,400 lb.

This gives a stress on the shaft, from the formula:

$$W = \frac{4 f z}{l}$$

$$\therefore 24{,}000 = \frac{4 \times f \times 101.9}{162}$$

$$\therefore f = 8{,}560$$

In addition to this, we have the stress due to the torsional moment, which is 13,000 lb. at 54-in. radius, and, calculating the stress from the formula:

$$\text{Torsional moment} = T = \frac{\pi}{16} d^3 \times f_r$$

$$\therefore 13{,}000 \times 54 = \frac{\pi}{16} \times 10^3 \times f_r$$

$$\therefore f_r = 3{,}580$$

Combining the two stresses we have

$$\text{Total stress} = \frac{f}{2} + \sqrt{f^2_r + f^2} = \frac{8560}{2} + \sqrt{3580^2 + \frac{8560^2}{4}} = 9{,}860 \text{ pounds.}$$

As might be expected, this shaft has broken repeatedly, a new shaft lasting only some five to eight months. At present the slope at which this hoist is installed is not being used so no attempt has been made to remodel the hoist, but I do not believe the shaft would stand unless increased in diameter sufficiently to reduce the total combined stress to not over 6,600 lb. And even then the arrangement is a poor one, as the gear, being so far from a bearing, will inevitably tend to set up vibration in the shaft. The proper cure would be to widen out the engine and install a third bearing next to the gear in the center of the shaft.

The chart is made up principally for shafts under bending strain only. For shafts under both bending and torsional strains the easiest way is to convert both into a total equivalent twisting moment by the formula:

$$T_1 = B + \sqrt{B^2 + T^2}$$

Where T_1 = equivalent total twisting moment in inch pounds

B = Bending moment = $\frac{W \times l}{4}$ in inch pounds

T = Twisting moment in inch pounds

W = Pull on shaft in pounds

l = Length between bearings in inches.

And then calculate the diameter of shaft required from the formula:

$$T_1 = 0.196\, D^3 \times f \quad \therefore D = \sqrt[3]{\frac{T_1}{0.196 \times f}}$$

using 6,600 lb. for the stress f.

To facilitate this calculation a scale of twisting moments has been added at the left-hand side of the chart. This gives the twisting moment that each diameter of shaft is good for at a stress of 6,600 lb. per sq.in.

For economy of material the shafts carrying rope sheaves are generally made like Fig. 3.

The chart will much simplify the determination of the various diameters, as the diameter required at any point A, to have a strength equal to that of the larger diameter in the center, can be found by reading from the chart the diameter required for the same load on a shaft with a span equal to $2X$; X, being the length from the center of the bearing to the point A.

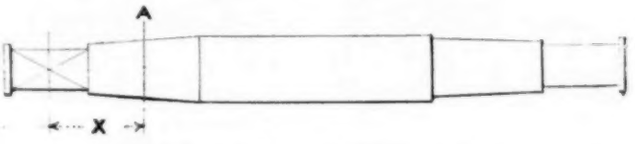


FIG. 3. CONVENTIONAL DESIGN OF SHAFT, BEARING CENTER LOAD

The English and the Metric Measuring System—A Comparison

By C. C. STUTZ

Considerable confusion exists as to just how the metric system differs from the English system, and why the compulsory adoption of the metric system would cause untold trouble and expense. Many advocates of the metric system are mixing the metric system with a decimal system. Because a certain measure is expressed in decimals does not mean that it is a metric measure, although many think so, and pro-metric advocates deliberately foster this mistake. This article also disabuses the mind of the common error that a carat is a metric unit.

THE fundamental importance of a system of weights and measures is, as a rule, not realized by the individual for the simple reason that the system has become automatically a part of his thought activity. He uses the system's units of length, weight and volume to visualize things, descriptions, expressions, conditions, relations, events, values, abstract facts and natural laws. His familiarity with them has become a habit and he uses them subconsciously. They have become, in fact, a part of his mental equipment. Thus they are taken for granted.

They are intimately interwoven into the business life, the home life and the intellectual life of every human being, man, woman and child. None can do without them. In every line of work they are used as tools and on the system they collectively form are based all achievements, are systematized and standardized all results of thought and work.

Based on them has been gradually built up during the years the life of the nation in its multiplicity of endeavors, represented by production, invention, industry and trade making for advancement, knowledge, betterment and comfort.

Now the suggestion is made that this system be changed for a radically different one, a system for which some advantages are claimed, but which has not as yet proved its superiority in the experience even of those who have accepted it.

The change from one system of weights and measures to another involves not only the stupendous task of changing the daily habits of the people, but also involves the application and use of both systems during the protracted period of education, incidental to which confusion and errors are a natural consequence. Nor is such a change accomplished without an enormous effort, which spells a cost practically beyond computation.

In the face of such conditions it behooves us, therefore, to examine very carefully the merits of the system of measurements offered to us in order to properly balance the advantages to be gained against the disadvantages so very evident. Such a comparison will be found in the succeeding paragraphs.

The metric system was, no doubt, at the time the eminent scholars conceived it, an earnest effort to create a scientific system of weights and measures. Unfortunately in those days industrial development was in its infancy and the men charged with the task, having no practical considerations to guide them, brought out a system based purely on theoretical lines.

Since then conditions have changed. Industry has claimed an increasingly important position and has enlisted in its service an ever-growing number of individuals. This multitude of artisans, in whose hands any system of measurements is but a tool like any other, has progressed or lagged behind according to the handiness and convenience of the system imposed upon it. Today the great industrial nations are the United States and Great Britain, both of which have resisted the introduction of the metric system as an implement lacking the qualities so necessary for rapid development. This does not imply that the English system of measurements is perfect. Some of its units and sub-divisions have become obsolete by disuse. This is as it should be. It is a matter of evolution and growth stimulated by experience and changed conditions and applies to most criticisms of this system.

Measures of Length

We have as Units of Length:

1 Yard = 0.9144 meters
1 Foot = 3.048 decimeters
1 Inch = 25.4 millimeters

And conversely:

1 Meter = 1.0936 yards
1 Decimeter = 3.937 inches
1 Centimeter = 0.3937 inches
1 Millimeter = 0.03937 inches

The accompanying illustrations, Figs. 1 and 2, show some relative comparisons of English and metric units of length. A study of Inch-Foot-Yard and Centimeter-Decimeter-Meter will show at once that the former three dimensions harmonize perfectly for practical use, while in the latter the unit sub-divisions of the meter represent too great a step from the meter itself. In the "inch" and "centimeter" the same defect is apparent to which is added the "indivisibility" of the centimeter

FIG. 1. FULL SIZE COMPARISON OF "INCH" AND "CENTIMETER"

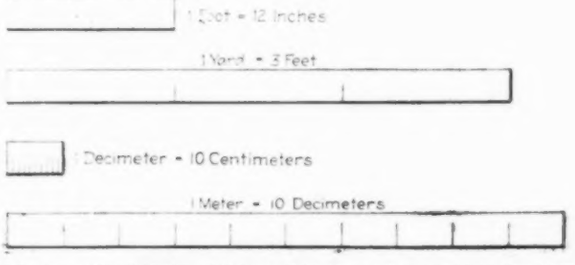


FIG. 2. RELATIVE COMPARISON OF ENGLISH AND METRIC UNITS OF LENGTH

as compared with the inch. To the mathematician this is a matter of indifference, but not so to the workman. Divide the inch into 1,000th's and the millimeter into 100th's, as required in work of precision, and the metric unit is too small.

The 1/1000th of an inch by means of the micrometer is used by the workman as easily as the inch itself, while the 1/100th of a millimeter, which is about 40 per cent of the former, requires an especially developed touch to be readily perceived. Thus the former dimension becomes a handy unit while the latter lacks this characteristic. In work of precision to cut down to one-half the allowable limit as a general rule, doubles the expense of production. On the handiness of the tools he used depends a workman's output. This explains why the American workman has made a success of the system of "interchangeable parts" and thus has made possible "standardization" in practically every line of endeavor.

There is no metric unit comparable with the "foot." This English dimension is used so universally that it would be a hardship to use the meter in its place.

The kilometer (1,000 meters) is the largest unit of length and is equal to 0.631 miles and conversely one mile equals 1.609 kilometers.

The nautical or sea-mile equal to 1.853 kilometers and being used universally by all maritime agencies the world over will probably never yield to the kilometer, because it is based on a rational and, for purposes of calculation, convenient basis. Sixty nautical miles are equal to one degree of the earth's circumference at the equator and therefore one nautical mile equals one minute of the arc.

Measures of Area

The common units are the square foot and the square inch and in the metric system the square meter and the square centimeter.

1 square foot = 0.093 square meters
1 square meter = 10.764 square feet
1 square inch = 6.452 square centimeters
1 square centim. = 0.155 square inches

The multiple units in our system are the acre and the square mile, several lesser multiples being very little used and practically obsolete.

The metric multiple units are:

The are = 100 square meters = 0.0247 acres
The hectare = 10,000 square meters = 2.4710 acres
The square kilometer = 1,000,000 square meters = 0.3861 sq miles

Here especially is noticeable the great difference in the values of units between the two systems. The English units evolved by experience and ante-dating the creation of the metric units have no convenient equivalents in the latter system.

Measures of Weight

The unit of weight in the metric system is the kilogram, equal to 2.2046 pounds. That this unit is an unhandy one because too large, is proved by the constant use in metric countries of the ½ kilogram as a substitute unit which is called the pound in everyday retail transactions in France, Belgium, Germany, Italy and Switzerland, and such expressions as ½ and ¼ pound are common in these countries at the present day. The tendency to use old local units is admittedly still pronounced in most European countries.

For goods handled and traded in bulk we have used the long ton of 2,240 pounds, but experience has shown that the short ton of 2,000 pounds is handier and this latter unit has displaced the former to such an extent that the long ton is being used less and less and will soon be obsolete showing clearly the adaptability of the English system to conform to changed conditions.

The metric ton of 1,000 kilograms is equal to 0.9842 long tons and equal to 1.102 short tons. It corresponds, therefore, closely to the long ton or the unit we are discarding.

A few words may be added here on Troy and Apothecaries weights and on the carat. These units have been devised for special purposes, where particularly small sub-divisions are required.

The Troy pound is never used, but its sub-divisions are employed to weigh gold and silver only; its smallest division is the grain. The grain is a uniform standard of weight, the same for the Avoirdupois, Troy and Apothecaries pound. The former has 7,000 grains while the latter two each have 5,760 grains.

The Apothecaries pound, or rather its sub-divisions are used only by physicians and druggists.

The carat is used only to weigh diamonds. Recently this unit was standardized and its value defined as 200 metric milligrams, showing clearly that for this purpose the decimal division of the metric gram was not suited. Though expressed in metric terms it is not a metric unit.

These special units covering small restricted and particular fields are a thing apart from the broad general scheme of weights and measures and bear no controlling influence on same.

Measures of Volume (Dry)

For units of volume (dry measure) we use cubic yards, cubic feet and cubic inches while the metric units are the cubic meter, the cubic decimeter and the cubic centimeter. They compare as follows:

1 cubic yard = 0.7645 cubic meter
1 cubic foot = 28.317 cubic decimeters
1 cubic inch = 16.387 cubic centimeters

1 cubic meter = 1.308 cubic yards
1 cubic decimeter = 0.035 cubic foot
1 cubic centimeter = 0.061 cubic inch

While the cubic meter is considerably larger than the cubic yard, its sub-divisions are so small that we have practically no approximate equivalent for the cubic foot and the cubic inch, units which have become indispensable, as shown by the far wider application they enjoy than the cubic yard. The wide divergence between them and the metric sub-divisions, which would have to be used in their place, points prominently to the unhandiness of the latter.

A unit for dry measure used extensively by the vast farming community of the country and those connected with its trade is the bushel. The standard United States bushel is a measure in cylinder form 18½ inches in diameter, 8 inches deep, containing 2154.42 cubic inches. One bushel = four pecks of eight quarts each, with two pints to the quart.

Because of the greater convenience of measuring many farm products by weight, especially when handling very large quantities, the practice has developed of adopting units of so many pounds, as per example 60 lb. for potatoes, 48 lb. for barley, etc.; and calling these units bushels. These weight bushels are approximations of the capacity bushel. In view of the ingrained character of the bushel standard to which the farmer clings tenaceously, the weight bushel which permits the buying and selling of farm products by weight serves a useful purpose.

When we consider liquid measures, we find in use the gallon which equals 3.785 liters, the metric unit. Conversely one liter equals 0.264 gallons.

The gallon is the largest unit. We have no multiple units of the gallon, because no need for such has developed, while in the metric system we find one decaliter = 10 liters and one hectoliter = 100 liters. These multiple metric units are confusing because of the limited call for their use.

On the other hand, experience has shown the need of a great many sub-divisions of the gallon hence we have quarts, pints and fluid ounces, a field which is very poorly covered by the decimal parts of the liter.

Binary and Decimal Divisions

During the centuries preceding the invention of the Metric system, which system was put together in the eighteenth century, systems of weights and measures were evolved by the various peoples living separated and apart from each other. Invariably such efforts were based on the binary system of division. The reason for this is plain. The mind works logically in that direction. Taking a measurement, be it length, area or weight, what is more natural than to halve it, then halve each part again and so down to the size which, for the problem before it, becomes the quantity wanted. This method presents the quality of ease and handiness, thus the path of least resistance is followed.

The method adapted by the metric system is to divide the original measurement or unit by ten and then express the quantity required as a multiple of one-tenth. In other words we compel the mind to travel in one direction and then retrace its steps.

A good example of the tendency to binary division is found in metric European countries where the expressions pound, half pound and quarter pound are much used in retail trade to indicate respectively ½, ¼ and ¼ kilogram, the correct values for these expressions being in the order named 500, 250 and 125 grams.

Individual units of the English system such as the inch, foot, yard and mile are often divided decimally to serve a given purpose. This must not be confused with the decimalization of a system which means the establishment of a decimal ratio between the units themselves.

Conclusion

Briefly stated the metric system is devoid of the English system's handiness and convenience; its units are either too large or too small for the every-day requirements of industry.

From the English system many sub-divisions have been dropped, having outlived their usefulness; thus proving the English system's adaptability to the requirements of progress. The metric system, on the other hand, presents a rigid structure incapable of modifications and requiring conditions to adapt themselves to its use.

Selling American Machinery in Foreign Markets

By H. M. HEIN

Manager, Machinery Department, Smith-Eisemann Corporation of America

THE average manufacturer in this country now realizes the possibilities of exporting machinery to foreign markets. He has heard "export" for the last five years, probably obtained a fair amount of orders and desires to continue increasing the demand for his machinery abroad. If his organization is a large one he will appoint a Foreign Sales Manager, giving him the necessary power and authority to develop the business in a large way and to "build business" by maintaining and increasing his relationship with foreign dealers or agents who have represented him or who are desirous of handling his line.

Some Serious Problems

Here the serious problem confronts the manufacturer. He will be satisfied to expend only a limited amount of money in the development of the export business, therefore the average export executive must rely absolutely upon the connections he has made, chiefly through correspondence. Does the average dealer in foreign lands want to be confronted with the problems of receiving a factory's quotation, all prices based f.o.b. factory; comparing the prices of one factory with another; translating an English technical catalogue into Spanish or any other language; paying cash (in most cases) against inland railroad bills of lading; converting American standards into metric system; and numerous other difficulties which arise, making the problem of the importer or agent a serious one?

The ideal method of introducing machinery in foreign countries is for the broad-minded manufacturer to establish an export department and conduct it along the exact lines he has used in developing his domestic business. Establishing such a department means more than obtaining the services of a high-priced executive. The export office should have its staff of travelers. These men should be representative, well acquainted with the countries' conditions, possess the proper technical knowledge and experience, know the languages of the countries thoroughly and be to a large degree conversant with their banking terms, conditions of sale, import duties and the like. Such men are hard to find and demand large salaries. Their expense accounts often prove disastrous to the factory that desires results.

Sending College Men Abroad

The alternative is to send bright young men, preferably college graduates, who are well acquainted with the factory's products, to foreign lands and give them sufficient time to get acquainted and make good. In addition to the selling force assistance from "back home" is necessary and the successful export department should have estimating clerks, shipping assistants familiar with packing and freight rates and French and Spanish stenographic forces. All of this means considerable expenditure and only the largest factories in this country are prepared to make an adequate investment for future returns.

We have yet to take into consideration the extension of credits in foreign countries. Volumes can be written on the subject of credit. It is a fact that the buyer is accustomed to longer terms than the average domestic dealer. The careful National banks in this country are all advocating a limitation of credits for export, yet the life of export depends upon the credits we are willing to extend to our foreign buyers and the subject must be carefully investigated by the credit department of the factory. It is the big end of the business and the life and growth of the volume of business depend largely upon handling it in the correct manner. If the average manufacturer has not the facilities to pursue this mode of operation the only other sensible alternative is to operate through an American engineering exporter.

Development of Business Through Exporter

Much has been written and said about the desirability and the undesirability of the American exporter. The word "exporter" has been applied to large technical engineering export-firms, who have been established for years, in the same breath as the "mushroom garden" variety of exporters who have sprung up during and since the war. The manufacturer should differentiate between these classes and get in touch with a firm of exporters who have representatives and offices in foreign countries and who are conversant with the line of machinery to be handled, thus developing and building up the business of the manufacturer in the various countries of the world. The exporter then eliminates for the manufacturer the cost of conducting an export department and at the same time enjoys the benefit of export business.

The average manufacturer should treat the exporter fairly, should not exact from him terms that are more stringent than he could ever hope to obtain from his domestic dealer, should give him the co-operation of the factory and all discounts that are furnished his domestic representatives and should appropriate a budget for *real* export advertising. It is also necessary that he place his confidence in the exporter in order to procure proper results. The contract between the manufacturer and the exporter should be for a minimum period of three years, to allow the proper time for each foreign branch and its representatives to introduce the goods and to develop and concentrate their efforts in behalf of the manufacturer.

The manufacturer should be willing to prepare his catalogs and price lists in the various languages, having the translation done by an efficient translator who understands technical phrases and their adaptation to Spanish or other foreign languages. This is an important matter as the language used in the description of a machine means to a great degree its saleability. Proper thought given to exporting of machinery will be the means of fostering our foreign relationship.

It is the writer's intention to alone emphasize the salient features based upon his knowledge and experience in development of foreign markets. The exporting of machinery requires more intensive sales promotion and concentrated efforts than any other articles, either raw products or finished, offered in foreign markets. The productive efforts of concentrated promotion would bring the desired results to our manufacturers and enable them to give just and due consideration to the export business.

A Modern "Contemporary" of an Old-Time Machinist

By James Tate

I very much enjoyed reading the "Reminiscences of an Old School Machinist," on page 533 of *American Machinist*, as it brought back to me very vividly the memory of my own apprenticeship days.

You will doubtless think that to have worked in a shop such as he describes I must be at least very nearly as old as Mr. Huntington, such has been the advance in shop equipment in this country in the past fifty years. Not so; it is a mere twelve years or so since I first received a warning "crack on the jaw" from the "heel tool" as we knew it, and to my knowledge, the same tools are still in use in that shop. This was in the machine shop, or rather "mechanics shop" of a weaving factory in Belfast, Ireland.

Center drills, as Mr. Huntington says, were unknown, the center was first prick-punched and then driven in with a heavy centerpunch and "batten hammer." When turning small studs, screws, etc., a "turner," as the lathe hands are known over there, would not think of changing gears and sharpening tools to cut one thread, but would take the material to the hand lathe, which consisted of a head and tailstock, with the necessary rests, mounted on the end of the bed of a long lathe, and proceed to rough out the piece, and cut the thread by hand, finishing with the chaser; completing a job in very good time, indeed, astonishing time compared with the work of some of our present-day mechanics.

We had no emery except the "buffing wheels" made as Mr. Huntington describes, and perpetually bald in spots; all our tools were ground on a heavy, slow-speed grindstone, which one of the apprentices would true up every Saturday, using a broken round file as a tool.

I have also used the machine he describes as a "cotter drill" for cutting keyways; although ours was improvised from an old drill press, using the compound rest of a lathe clamped to the table to hold the work and to get the feeds which, of course, were by hand. All our keyways and slots were cut on this machine, except when it was busy and we had no time to wait; when we would cut keyways on the shaper, or, failing that, clamp the shaft in a vise, mark off and cut the keyways by hand.

All keyways in pulleys, crank webs, etc. were cut out by hand, using a small, home-made T-square to mark the location in the hub, then chipping out the slot with a cape chisel and finishing it with a file.

The ordinary day's work in many a small repair shop of this character in the "old country" would make the boss of many modern machine shops engaged in maintenance work over here gasp for breath. I don't know the reason for it, except perhaps that the mechanics working with such meager equipment must use their brains more than those who have everything they need at hand, and that this stimulated intelligence is reflected in their work. However it may be, there is a great deal to be said for the old-time mechanic, who would tackle anything and get away with it; and by old-time mechanic I mean not only those who are really "old-timers" but those who, by virtue of working with the same kind of equipment and under the same handicap, become imbued with the energy, initiative, and versatility which made the "old-timer" the grand mechanic that he was.

WHAT *to* READ
—*for the man in a hurry*

Suggested by the Managing Editor

FRED COLVIN has by no means exhausted his supply of information on the machine work connected with the manufacture of passenger automobiles but this week, for variety's sake, we are switching in a tractor article as a leader. Few of us, perhaps, think of California as anything but a land of sunshine and flowers, good roads and mountain scenery, gold mines and oil wells, but as a matter of fact there are many thriving, well-equipped shops and manufacturing plants. Among them is the tractor plant described where they build a big machine of the track-laying type.

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots

Passing over the other general articles for the moment we want to direct your attention to the letters from our London and Berlin correspondents on page 923, and particularly to the German one. This issue of the *American Machinist* is coincident with the annual meeting of the Machine Tool Builders' Association and we consider ourselves fortunate to be able to give at this time Mr. Herzog's clear analysis of the machine-tool situation in that unhappy country. As announced before, Mr. Herzog has been appointed to represent the McGraw-Hill papers in an editorial capacity in central Europe. We have arranged to have him send to the *American Machinist* periodical letters on German conditions corresponding to the able ones coming from Mr. Chubb in London. The one appearing in this issue is the first of the series and Mr. Herzog has thought it wise to introduce his letters with a general summary of the status of the machine industry for the past few months. He mentions the wide fluctuations in the export prices of German machine tools—2,000 to 3,300 per cent *above* pre-war figures. The failure and disposal of the plant of the so-called German Niles works is only one among many interesting items. It is a gloomy picture but hardly more so than the one drawn by Chubb in the English letter that follows it. We know what a coal strike is and what suffering and unpleasantness one can cause, but thank fortune we have never had one with an Irish question thrown in for good measure—not to mention a threatened rail strike on top of everything else. Reconstruction seems to be quite as much of a task for England as for the rest of us. Following these letters we have a few notes on the general situation in Italy.

But to return to the front of the paper. Part XII of "Modern Production Methods" starts on page 889. The immediate subject is "Fixed Charges" and Mr. Basset proceeds to explain what to do with them in a convincing way. But his outstanding feat in these few pages is to find something good in the Federal Income Tax Law! You will have to read the article to find out what it is.

This being an off-week in Mr. Morris's apprentice training series we are slipping in a description by L. C. Morrow of the staff, of the training department in one of the big Cincinnati machine-tool plants. Specialists as well as apprentices are trained.

When is a contract not a contract? "Always!" we hear some disillusioned machine-tool builder murmur and recent events in a certain field make us wonder if he isn't right. But aside from the present temporary difficulties the one time when a contract is likely not to be binding is when the labor union is one of the parties. It probably isn't entirely the fault of the union but the real trouble is beyond the wit of the layman to discover. Chesla Sherlock gives some of the facts in the case and quotes decisions to prove his contentions, beginning on page 897.

Two more articles on employment matters will be found on pages 902 and 905 and seem to indicate that this issue deals principally with management. Such was the purpose although not to the exclusion of other articles as the ones on number of teeth in contact of two meshing gears, page 899, precision gages, page 884, and design of taps for steep lead, page 887, will testify.

Breach of contract to the average individual means something scandalous connected with chorus ladies and young (or old) millionaires. What is much the same thing in the eyes of the law is dignified by the term "cancellation" when it comes to business contracts. See page 918 for our point of view on this evil.

Anti-Metric Resolutions

WHEN the pre-metric advocates manage to get some unsuspecting non-industrial body to pass a resolution favoring their cause they immediately try to persuade people in general that there is a landslide coming along in their favor. However, the following resolutions from really representative industrial bodies tell a different story. Please note the recent date in each case.

National Associations

Automotive Wood Wheel Manufacturers' Association, Convention, Cedar Point, Ohio, Aug. 13, 1920:

The Automotive Wood Wheel Manufacturers' Association records its opposition to the compulsory adoption of the Metric System of weights and measures, which various interests are asking Congress to legislate for. We believe that attempts to compel its adoption in the United States are unwise, unnecessary, and calculated to disturb seriously the standards of measurement now uniformly used in this industry.

Hickory Products Association, Convention, Cedar Point, Ohio, Aug. 12, 1920:

The Hickory Products Association records its opposition to the compulsory adoption of the Metric System of weights and measures, which various interests are asking Congress to legislate for. We do not oppose the Metric System as such, but believe that attempts to compel its adoption in the United States are unwise, unnecessary, and calculated to disturb seriously the standards of measurement now uniformly used in this industry.

Photographers' Association of America, Convention, Cleveland, Ohio, Aug. 26, 1920:

Whereas, The members of the Photographers' Association of America, in annual convention assembled, have heard the arguments in opposition to any change in the present form of our standard weights and measures, and

Whereas, It is universally conceded that any change to any other system would work a great inconvenience in a business such as photography, where weights and measures are a part of the daily routine,

Therefore, Be It Resolved, that this association go on record as opposing any action, legislative or otherwise, that would bring about any change in our present form of standard weights and measures; and further be it resolved that the activities of the American Institute of Weights and Measures on behalf of the present standard weights and measures be highly commended.

Steel Barrel Manufacturers' Association, New York City, Aug. 3, 1920:

This association is in sympathy with the efforts to maintain our present system of weights and measures.

District Associations

Southern Metal Trades Association, Convention of North Carolina Division, Norfolk, Va., Aug. 26, 1920:

Resolved, That the North Carolina Division of the Southern Metal Trades Association hereby declares its opposition to any legislation having for its purpose the adoption of the Metric System in the United States as the exclusive legal standard of weights and measures.

Resolved further, That we commend the work of the American Institute of Weights and Measures in opposition to the compulsory adoption of the Metric System.

Southern Supply and Machinery Dealers' Association, Convention, Atlantic City, 1920:

Be It Resolved, That it is the opinion of the Southern Supply and Machinery Dealers, in convention assembled, that the adoption of the Metric System would seriously interfere with long established methods of doing business, and that without any degree of benefit, and we, therefore, desire to go on record as being opposed to any change from the present standards.

State Associations

New Jersey Lumbermen's Association, Executive Committee, Newark, N. J., Sept. 14, 1920:

Be It Resolved, That the New Jersey Lumbermen's Association is decidedly and unanimously opposed to the adoption of the Metric System. It is felt that the adoption of this system would result in endless confusion and great expense, and there is no necessity for a change in our system of weights and measures.

Michigan Implement Dealers' Association, Board of Directors, Aug. 17, 1920:

Whereas, Certain interests are using their best efforts to have passed by Congress a compulsory Metric System of Weights and Measures, and as this would cause endless amount of confusion and expense, we, the directors of the Michigan Implement Dealers' Association assembled, are opposed to any change of our present system of weights and measures.

Kentucky Manufacturers' Association, Board of Directors, June 4, 1920:

The directors expressed unanimous disapproval of the measure now pending in Congress and which provides for the adoption of the Metric System Standard of Measurements in the United States. The motion carried with it instructions that the resolution be placed in the hands of the chairman and members of the Committee on Coinage, Weights and Measures in the House.

Oregon Retail Jewelers' Association, Executive Board, Albany, Oregon, Sept. 1, 1920:

The Executive Board of the Oregon Retail Jewelers' Association wish to go on record as being opposed to any change in the American Standard of Weights and Measures as are now in use. We consider it unwise to enact any laws that will cause business men of the country any unnecessary work or inconvenience at the present time.

Hawaiian Sugar Planters' Association, Trustees, Honolulu, T. H., Sept. 17, 1920:

This association is opposed to any change being made in the American standard of weights and measures.

City Associations

The Master Builders' Association of Boston, Board of Directors, Aug. 4, 1920:

Re. the efforts being made by the World Trade Club of San Francisco to establish the Metric System in place of the present system of weights and measures existing in this country . . . The Board of Directors of this association is strongly opposed to such a change.

Muskegon Employers' Association, Muskegon, Michigan, Governing Board, July 13, 1920:

Whereas, The industries of this nation have been built upon the English system of weights and measures, and

Whereas, National legislation is proposed to make the Metric System compulsory, and

Whereas, Such a change would cause great confusion, require enormous expense and would be generally detrimental to business, now therefore, be it

Resolved, That the Governing Board of the Muskegon Employers' Association, representing 95 per cent of the manufacturers, merchants and others of this community, does hereby condemn and oppose all legislation which would

provide for the compulsory use of the Metric System, or which would change our present system now in general and satisfactory use.

CHAMBERS OF COMMERCE

Waterbury, Conn., Chamber of Commerce, Board of Directors:

On record as opposing the Metric System of weights and measures, and as favoring the retention of the present system.

Newburgh, N. Y., Chamber of Commerce, Board of Directors, April 13, 1920:

This question has been discussed by the officers and directors of our Chamber of Commerce and the secretary has been directed to inform you that our association is decidedly opposed to the adoption of the Metric System on account of the endless confusion and great expense that will be caused by making the change, and also on account of the lack of necessity for so doing.

Syracuse, N. Y., Chamber of Commerce, Board of Directors, Aug. 9, 1920:

Be It Resolved, That the Syracuse Chamber of Commerce is unanimously opposed to legislation intended to promote the compulsory adoption of the Metric System of weights and measures in this country.

Hoboken, N. J., Chamber of Commerce, Board of Directors:

The Board of Directors voted to oppose the proposed plan to adopt the Metric System on the ground that at this time any change would be unwise.

Pennsylvania State Chamber of Commerce, Board of Directors, Harrisburg, Pa., April 7, 1920:

Action was taken "opposing any compulsory adoption of the Metric System."

Greater Wilkes-Barre, Pa., Chamber of Commerce, adopted by the Board of Directors, March 16, 1920:

Your committee unanimously advises against the recommendation of the adoption of the meter-liter-gram system by the Rotary Club and Chamber of Commerce of Wilkes-Barre.

Johnstown, Pa., Chamber of Commerce, Inc., Board of Directors, July 22, 1920:

The Chamber of Commerce has gone on record as being opposed to the adoption of this system at this time.

York, Pa., Chamber of Commerce, Board of Directors, Sept. 7, 1920:

The Board of Directors of the Chamber of Commerce . . . "put themselves upon record against the official adoption of the Metric System in the United States.

Cleveland, Ohio, Chamber of Commerce, approved by the Board of Directors, June 16, 1920:

Your committee, after consideration of its investigation and of the facts that have come to its attention, earnestly urges the Chamber of Commerce to go on record as being absolutely opposed to the compulsory adoption of the Metric System of weights and measures in this country, and strongly recommends that the Chamber of Commerce direct communications to the members of the Committee of Coinage, Weights and Measures of the Congress of the United States, and to all of the representatives of Ohio in the Congress of the United States, opposing a legislation which will in our opinion be so disastrous to all of us.

Springfield, Ohio, Chamber of Commerce, Board of Directors, Aug. 9, 1920:

Be It Resolved, That the Board of Directors of the Springfield Chamber of Commerce are opposed to the adoption of the Metric System.

Flint, Mich., Board of Commerce, July 1, 1920:

The Industrial Department records its unanimous opposition to the voluntary adoption of the Metric System and recommends that its entire membership as a body go on record in disapproval of the voluntary adoption of the Metric System.

Moline, Ill., Commercial Club, Board of Directors, July 19, 1920:

On record as being opposed to the compulsory adoption of the Metric System.

Pueblo, Col., Manufacturers' Association of the Commerce Club, Aug. 18, 1920:

Be It Resolved, That the Pueblo Manufacturers' Association of the city of Pueblo, Col., do hereby condemn the efforts now being put forth to effect a change in the existing system of weights and measures. They consider such a move to be inimical to the industrial interest as well as the commercial interest of this country.

TECHNICAL SOCIETIES

American Association of Engineers, Oklahoma Chapter, Aug. 7, 1920:

The chapter is against the adoption of the Metric System in this country at this time on account of the enormous expense and confusion incident thereto.

The Hydraulic Society, Chicago, Ill., Sept. 20, 1920:

Resolved, That this society is opposed to the movement to force the compulsory adoption of the Metric System in this country, and that a copy of this resolution be transmitted to the appropriate Congressional Committees having in charge the legislation that was introduced in the last Congress with this purpose in view.

The Compressed Air Society, Quincy, Ill., Sept. 18, 1920:

Unanimously voted that the society go on record as being opposed to the Metric System.

The foregoing resolutions opposing the metric system are in addition to the many we have previously published.

Thos. Viall

Editor

EDITORIALS

Sales Contracts and Fair Play

THE spirit of the times is rightly one of give and take. Unfortunately some buyers of machine tools have viewed their contract obligations less seriously than usual and unfair practices have come to light in a few instances. A machine tool sales contract made in good faith should be respected and no cancellation should be accepted unless it is requested for justifiable reasons.

When it is considered that the development and use of machine tools are responsible for much of the world's advancement it is only just that the business of manufacturing them should be productive of a fair return to investors and that such return should come without running the gauntlet of too many risks. The machine tool builders have been asked to bear more than their share of the readjustment burdens and must protect themselves from unethical business practices that are adding needlessly to the load. Many of the other industries have not been called upon to face this problem and do not appreciate its serious nature.

The leather industry is experiencing a dearth of new orders and the same is true of the structural steel industry. However, orders in process are being completed. Concellations as such are not playing an important part.

In the electrical merchandise and construction fields cancellations appeared to be reaching dangerous proportions several weeks ago but later proved to be false alarms. This is explained by the fact that the fear on the part of dealers that demand was decreasing was unfounded. Reinstatements almost always followed the cancellations immediately and they were frequently accompanied by increases in orders.

Coal is in such demand that there have been few cancellations, although some have been given in the bituminous branch on account of the falling market. Their extent has not been alarming.

While the automobile manufacturers have been experiencing smaller sales, they have not been subjected to uncertainty due to cancellations because their system of selling to dealers a standardized product as stock, permits flexibility in manufacture and therefore more ready adjustment to offset lessening demand.

The textile industry in the spring of 1920 received many cancellations. The mills fought them in many cases, generally insisting that goods in process at the time the cancellation was requested be accepted by the buyer. The American Association of Woolen and Worsted Manufacturers appointed an Unfair Practices Committee to consider and pass on individual cases where cancellations were desired. It has been found that when the facts are determined the decision must generally favor the manufacturer, that is, the mill or its representative. One large firm in New York representing several mills has had only three decisions against it out of four hundred cases.

From California comes the statement of the California Prune and Apricot Growers' Association that while it is willing to co-operate in every way with buyers desiring extensions of time, it will stand firmly on its legal rights on all firm-at-opening price contracts made this year and will institute court action against buyers who repudiate their contracts. Prunes and planers are vastly different but the principles involved in cancellations are much the same everywhere.

The prune growers advance the argument that the buyers made no objection to the profits they obtained for a rising market and should now accept losses from a falling market without whimpering, especially in view of the fact that in both cases prices were determined upon what was considered a fair basis and contracts entered into accordingly.

The Association of German Machine Tool Builders in October, 1918, adopted conditions for the sale of machine tools embodying the following: An order shall be binding only after it has been accepted in writing by the builder. Orders placed with all terms and agreements in writing cannot be revoked. If proof can be furnished that delivery is delayed through actual fault of the builder, the purchaser can demand an indemnity which in no case shall be more than the actual loss sustained and properly certified and shall be in the maximum ½ per cent of the contract price for every week's delay and under no circumstances more than 3 per cent totally. All further claims, also the right of the purchaser to annul his contract are not admissible. In addition to the points noted the purchaser is given certain rights of cancellation if the builder does not deliver within the allowed extension of time and if he does not make repairs as agreed upon.

The German contract is drastic and probably would not be enforceable under our laws even if good business policy permitted its adoption here.

Cancellation of contract, as we have used the term here and as it is generally accepted in the industry, is not recognized at law. The legal term is breach of contract and the remedy open to the injured party is a suit for damages. He cannot force the acceptance of the goods and his damages in most cases amount to the difference between the contract price and either the market price or the cost of production, depending upon circumstances. In any case the cost of extensive litigation is more than likely to eat up the greater part of any damages that may be secured. And the wise business man will hesitate before taking a step that is sure to cost him a customer.

The requirement of a deposit with the order is also open to serious question as a workable scheme to protect the manufacturer. While there is no doubt that such a demand would be entirely justified, it is equally certain that deposits would not be asked for in some cases and would be returned if requested, in others.

There remains only the employment of some sort of Fair Practice Committee like those existing in some of the other industries and trade associations. Many of these bodies have been markedly successful in improving the moral tone of the business practices in

their respective fields. They require the honest and hearty support of the members of the association, however, if they are to succeed, and only such an organization as the National Machine Tool Builders' Association can put through a plan of this sort for the machine tool industry.

The Fair Practice Committee seems to be the logical means to employ, for the reason that the kind of cancellation or breach of contract that is causing the trouble is the one resorted to by sharp purchasing agents or managers who are cancelling existing contracts with the hope of reordering at lower prices. This practice is indefensible on any ground but the wornout saying "Business is business" and merits extreme measures to check it. These measures could be taken by a Fair Practice Committee which would distinguish between justified and unjustified cancellations. Machine tool builders, like other manufacturers, realize that in these days of reconstruction it is often necessary to extend credit beyond the usual limits to distribute the burdens as fairly as possible but there is no adequate reason why they should be made the victims of unfair business methods.

Fundamentals of Standard Hole Practice

MANY of us talk glibly about tolerances, limits and interchangeable manufacturing, but in too many cases there is lack of understanding of fundamental principles which adds materially to the cost of construction. In a recent case which came to notice, the cost of building a lot of machines was reduced twenty per cent by having the drawings gone over by a competent man and the tolerances properly set.

Perhaps the first step in the right direction is to thoroughly understand what is meant by "standard hole" practice. This has been almost universally adapted by leading builders of standard machinery, but there still remains much misunderstanding in regard to it. By getting this firmly and correctly fixed in mind, the problem becomes comparatively simple.

Standard hole practice means that the external member shall never be *smaller* than the basic size and that all tolerance shall be *plus*. The internal member on the other hand, shall never be *larger* than the basic size and all tolerance shall be *minus*. The external member may be a ring or a piece which partially incloses the internal member, as a keyway, the internal member being the key.

This means that the tolerance is always one way on each piece—and not "plus or minus" on the same piece as we are apt to consider it. It means that we must revise our thinking in many cases, and not think of "plus or minus" in the way it is often mentioned.

The advantages of this system are twofold. The tolerances do not allow any overlapping of sizes, which would require selective assembly as no internal member can be larger than the smallest permissible external member. The second advantage is that it permits the use of standard gages as the limit in one direction.

Assuming a two-inch collar and shaft as the example, the minimum diameter of the collar could be determined by a two-inch plug gage while the maximum shaft diameter would be given by a two-inch ring. With a tolerance of 0.005 in. on each part, *plus* on the collar and *minus* on the shaft, the minimum looseness would be 0.000 in. and the maximum looseness 0.01 in. with the average probably 0.0025 in. But in each case the standard gage can be used as a check to insure the parts going together.

This question is now being considered internationally and is a live factor in economical manufacturing.

F. H. C.

South Americans to See U. S. Manufactures

THE success which has already attended the efforts of the American National Expositions, Inc., in planning an exposition of the manufactured products of the United States in Beunos Aires, Argentine Republic, indicates that the affair will be a notable event in the development of our trade with Latin America. The exposition will be held in March and April, 1921, in permanent buildings devoted to such purposes. The offices of the enterprise are located in the Bush Terminal Sales Bldg., New York City.

The Department of Commerce of the United States is co-operating with the management of the exhibit and enthusiastically lending its moral support. The reason for this lies in the fact that the display in South America of a comprehensive collection of products from the United States should be a means of promoting friendship and commerce between the United States and South America.

The exposition is being boosted and advertised extentively in South America by the Chamber of Commerce of the United States of America in the Argentine Republic, which organization has headquarters at Beunos Aires. This body recently issued a bulletin telling the history and the practical value of expositions. The bulletin states that this exposition is believed to be the first one in history to show the products of one nation exclusively to the public of another nation. Another statement is: "The exposition is still what it was of old—*the simplest, most practical method whereby the greatest number of competing lines can be seen and compared by the largest number of persons in the shortest time at the least expense.* A thousand years of progress have brought no better plan."

It may seem that the advantage is all with the buyer; but the manufacturer or the seller who has a product which he is willing to match against that of his competitor can expect to obtain marked results at low cost. One of the best ways of selling goods is by showing them. Goods often sell themselves, merely by suggesting their desirability to persons who did not realize that they wanted them until they saw and examined them. This is the psychology of the show window.

A characteristic advantage of public displays or expositions is that they attract both the wholesale and retail buyer. Most other selling methods are aimed either at the merchant and distributor or at the ultimate consumer. "An exposition gets both at one blow, stimulating distribution and demand simultaneously."

Our manufacturers seem to realize the value of the exposition, not only because of the nature of the plan itself but also because of the possibilities of the territory in which it will be held. The machine-tool builders should be complimented upon the manner in which they have responded to this opportunity for foreign expansion, as space for exhibits is now at a premium.

C. J. P.

SHOP EQUIPMENT NEWS

-Edited by-
S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

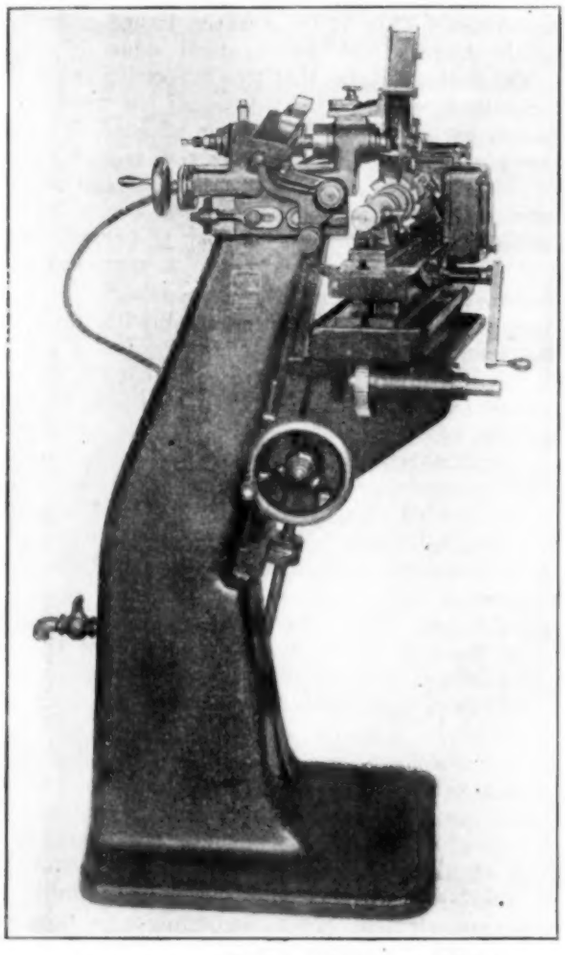
• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

Pratt & Whitney "Curvex" Cutter Grinding Machine

The Pratt & Whitney Co., Hartford, Conn., has recently brought out the cutter grinding machine illustrated herewith.

While this machine was primarily designed for grinding the teeth of "Curvex" cutters it can be used on any cutters that require grinding on the face of the teeth. The machine is equipped with a wheel having a beveled edge, being the only shape that will follow the face of a helical tooth of a formed and relieved cutter and maintain the exact contour of the cutting edge. The table on which the cutter is mounted can be swiveled at an angle corresponding to the helix angle of cutter to be ground, the axis of the table intersecting that of the spindle and grinding wheel. The table is reciprocated in the usual way by means of a crank. At the same time a reciprocal rotary motion is imparted to the cutter through a set of change gears selected to conform to its lead.

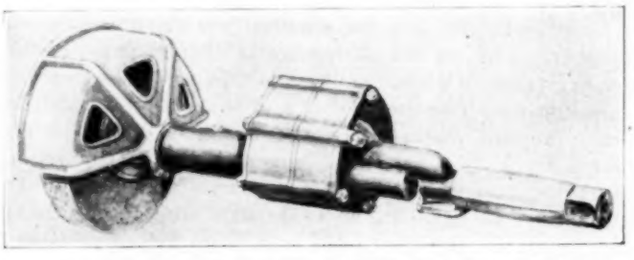
Two features of the machine insure the precision required for grinding formed cutters having helical teeth. The first is an indexing device for successively bringing the teeth in line for grinding instead of holding the back of each tooth against a spring stop. The second is the provision for grinding cutters of different sizes radially without resetting the head or table in any way except in elevation. The knee on which the table is supported slides on an inclined bearing on the column, the angle of inclination being parallel to a line drawn across the beveled face of the grinding wheel. The grinding wheel is so located in relation to the mandrel on which the cutter is mounted that the line of contact between the cutter and wheel passes through the center of the mandrel and so coincides with the radius of the cutter. By this arrangement the grinding line is always radial. An accurately mounted diamond tool is provided for dressing the grinding wheel to the correct shape. The machine can be used for either wet or dry grinding.



"CURVEX" CUTTER GRINDING-MACHINE

Roto-Pneumatic Series-A Grinding Machine

The portable pneumatic grinding machine shown in the illustration is made by the Roto Pneumatic Tool Co., 4,700 Train Ave., Cleveland, Ohio. It is known as the Series-A machine and is intended for light grinding and polishing work. The air enters the machine through the control handle and is applied to the pistons, which are integral with the rotating shaft, no cranks or connecting rods being used. The air control is balanced, so that the throttle will stay in any position in which it is placed. It is claimed that the device is free from noticeable vibration and that it can be easily controlled.



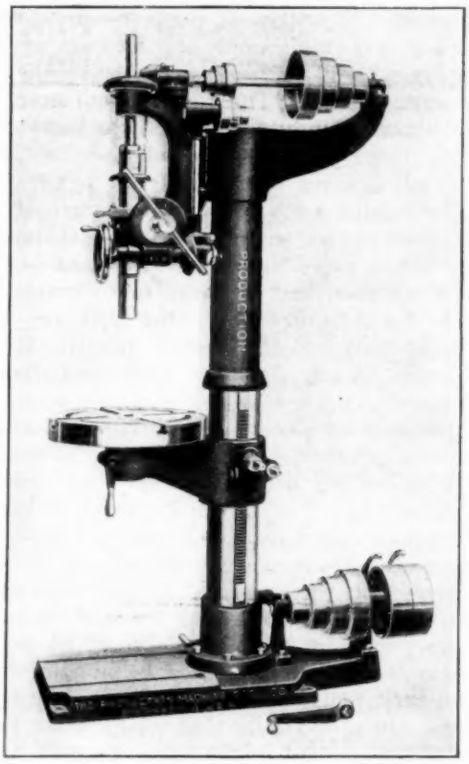
ROTO-PNEUMATIC PORTABLE GRINDER, SERIES-A

The cylinders and valve chest are made of bronze, as also are the bearings. Oil from a reservoir is supplied to the motor bearings through the center of the shaft, and the cylinders and valves are lubricated automatically by the pumping of a small amount of oil through them at each revolution.

It is stated that under average conditions the air consumption is 15 to 20 cu.ft. of free air per minute at a pressure of 80 lb. per square inch. Either a 6-in. or an 8-in. wheel can be used. The weight of the tool is 14 pounds.

"Production" 22-In. Upright Drilling Machine

The Production Machine Tool Co., 629 E. Pearl St., Cincinnati, Ohio, has recently placed on the market a 22-in. upright drilling machine with stationary head.



"PRODUCTION" 22-IN. UPRIGHT DRILLING MACHINE

Specifications: Capacity, drills to center of 22-in. circle. Spindle speed, back gears in, 20, 33, 53, 88 r.p.m.; back gears out, 117, 196, 318, 530 r.p.m. Power feed per revolution of spindle, 0.006, 0.010, 0.015 in. Distance from spindle to base; maximum, 45 in.; minimum, 35 in. Distance from spindle to round table; maximum, 25¾ in.; minimum, 9¾ in. Diameter of round, table, 18¼ in. Spindle; diameter, 1 5/16 in.; hole, No. 3 Morse taper; vertical traverse, 10 in. Column diameter, 6 in.

The machine shown in the illustration is intended for drilling, boring, tapping and facing holes up to and including 1¼ in. in diameter.

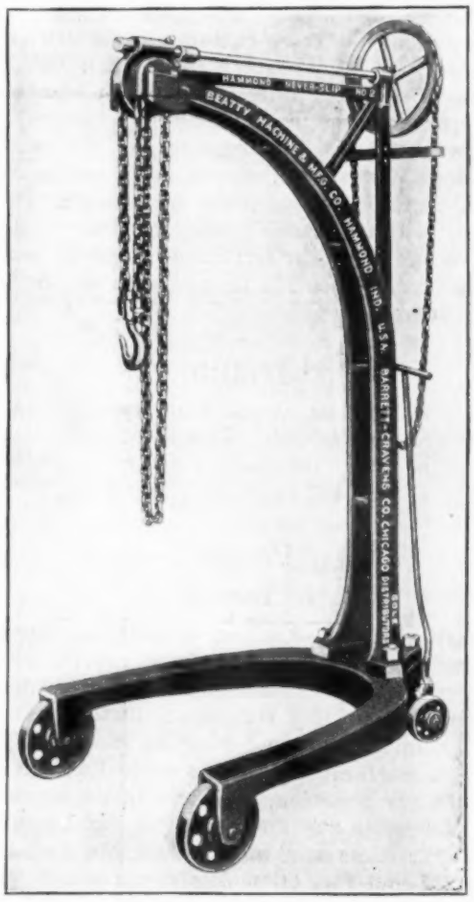
The table-elevating worm is located on the right-hand side, and it is claimed that the controls are all within easy reach of the operator. The bevel gears driving the spindle run at a speed of less than 800 ft. per minute, so as to reduce noise. The spindle is equipped with a ball thrust bearing and is counterbalanced. All bearings are equipped with bronze bushings, which can be readily replaced when necessary.

Four spindle speeds are obtainable on the plain machine and eight on the machine equipped with back gears. The rate of power feed can be varied by means of a belt on cone pulleys, three feeds being provided. The feed motion is transmitted through worm gearing running in oil. A positive clutch is provided to engage the power feed. The power feed mechanism can be omitted if desired and a ratchet feed lever furnished. A tapping attachment can be supplied, as well as any type of drive desired.

Hammond "Never-slip" Portable Crane

The Barrett-Cravens Co., 169-173 North Ann St., Chicago, Ill., is the sole distributer of the portable crane illustrated herewith.

The base and column of this crane are steel castings and the hoisting device is directly supported by the column arm. All wheels are equipped with Hyatt roller bearings and the axles are chrome-nickel heat-treated steel. The hoisting gear consists of a bronze worm-wheel and steel worm inclosed in an oil-tight casing. Besides being locked at all points of travel, the worm gearing permits very close adjustment in the height of the load.



HAMMOND "NEVER-SLIP" PORTABLE CRANE

Specifications: Made in 6 sizes. Lifting capacities, 2,000 to 7,000 lb. Heights, 6 ft. to 10 ft. 8 in. Amount of lift, 4 ft. 10 in. to 8 ft. 6 in. Overhang, 2 ft. 5 in. to 3 ft. 8 in. Floor space, 3 ft. x 3 ft. 6 in. to 4 ft. 3 in. x 4 ft. 10 in. Weight, 575 to 1,400 lb.

Pratt & Whitney "Curvex" Cutters

Formed and relieved cutters with helical flutes, as shown in the accompanying illustration, have recently been put on the market by the Pratt & Whitney Co., Hartford, Conn., under the trade name of "Curvex."

Owing to the helical flutes, each tooth comes in con-

"CURVEX" FORMED CUTTERS

tact with the work progressively and cutting takes place, not along a line, but diagonally across the face of the work with a shearing action. The angle of the helix is such that one tooth enters the work before the preceding one has cleared it, thus eliminating the chopping action of a cutter with straight flutes and minimizing the tendency to chip or break either the teeth or the work.

It is claimed that these cutters can be run at faster speeds and will take heavier feeds than will formed cutters with straight flutes; also that under all operating conditions they will produce a smooth surface free from chatters. The cutters are produced by a single-pointed tool following a templet corresponding to the form of the work they are to produce.

"Curvex" cutters are only made to order and can be cut with either right- or left-hand helices of practically any lead from 1.607 to 125 in. and with any helix angle up to 20 degrees.

Erratum

On page 871 of last week's issue appeared the heading "Nemo" Rust Remover. This is an error—the trade name of the rust remover, marketed by Peter A. Frasse & Co., Inc., 417 Canal St., New York, is "Meno."

Future Power Supply

BY ENTROPY

The earliest recorded power from inanimate objects was water power, in which a slowly moving river was made to pump a small portion of its own waters high enough to be used for irrigation, instead of waiting for the annual inundation. Now we seem to be getting ready for a much more scientific method of using water power, one far reaching, which is thrust upon us not because its use is any more sensible but because, having been thriftless and improvident, we find that the cost of coal and fuel oil makes it necessary for us to become provident. We can only hope that we are beginning in time.

No matter how efficiently we develop water power and no matter how thoroughly it is distributed there is not enough to go around and its price to the consumer is bound to be quite as high as the cost of developing the remainder whether it comes from burning coal, crude oil or gasoline. For that reason we are and always will be much concerned over the supply of fuels.

Coal and petroleum are nothing but the petrified and dissolved remains of vegetable growth of thousands of years in the past. Peat is forming now, but there is nothing to make us think that it will become coal, nor is there enough of it to afford any great supply if it should. There is shale rock in quantities from which oil may be distilled, but what shall we burn to distill the oil from it? The supply of crude petroleum in the United States is likely to be exhausted during the present generation if the scarcity and high price prevail to bring out the supply. The Mexican fields are not showing signs of exhaustion but since they are the most profitable source of revenue to the Mexican government it is more than likely that they will be exploited to their utmost regardless of the length of time they might be made to last. In other words nature has provided just so much and no more of these supplies, and is apparently not making more. It puts it distinctly up to us to provide for ourselves.

It appears then that barring the discovery of additional coal and oil we shall have to produce the power needed over and above water power by some process that will use the energy which is coming to the earth rather than from energy which has been stored up for us. In other words we shall have to produce it by means of the sun's rays.

Direct production of power from the sun's heat has been done but it is cumbersome and does not work when clouds intervene and is least available in the winter when we most need it. The readiest and most simple method of using sunlight for power is by growing trees and cutting them for firewood, but firewood is bulky and not at all adapted to many of our power requirements. We need a more concentrated store of energy for ships, locomotives, automobiles and airplanes. The one such concentrated form just now appears to be alcohol. More than that we have innumerable factories for the manufacture of alcohol that are, for the time being at least, out of business, available with very slight changes, if any, to make denatured alcohol for power purposes.

Experiments with alcohol in internal combustion engines indicate problems no more insurmountable than those met in dealing with gasoline. They are simply different problems. The fact that we had a very good supply of gasoline at a price that was not unreasonable has deterred us from experimenting very thoroughly with alcohol, but whenever necessity, the mother of invention, catches up with us we can most surely make the necessary changes to make the new fuel successful. The trouble is that we have been lacking in thrift, as we usually are, and have been so extravagant in consuming the stores of nature that we have not had time to think about the future and the absolute certainty that before very long all our elaborate science of internal combustion engineering will all be left a waste on our hands if we do not change our policy.

Of course it is possible that other distillates may prove better than alcohol, but the future distillate will probably be something which is raised from the soil, for that is the only way that we now have for storing the sun's energy. Reducing it to alcohol is simply a means for concentrating the energy in a lesser weight and bulk for ease in use. The heat energy of the remainder of the vegetable product can be utilized to some extent to furnish the heat necessary to distill off the alcohol.

If we go on an alcohol basis for power we will truly be using sun-power at very close hand. Vegetation depends on sunshine and water. The water comes because the sun has evaporated it from the ocean and ponds, and the sun light comes direct. This energy cannot possibly be exhausted in a time within our conception.

The Machine-Tool Industry Abroad

The German Machine-Tool Industry Today

By OUR BERLIN CORRESPONDENT

THE GERMAN machine-tool industry has gone through one of the most critical periods of its existence. The unheard-of revival of the trade in 1919, whereby the output was literally torn out of the hands of the manufacturers and orders were given without looking at the price or the delivery time, reached its climax at the beginning of this year. During the months of January and February the demand decreased, but so slowly that it escaped the notice of even the Machine Tool Builders' Association, which is in an exceptional position to feel the pulse of the market. In a meeting of this society, which was held as late as February, 1920, it was proposed to raise the export prices for machine tools to 3,300 per cent of the pre-war standard and some of the members declared this proposal to be moderate and not at all sufficient to exhaust the possibilities. Four weeks later the demand fell off in one sudden drop. It was commonly believed at that time that this drop would be short-lived and would be followed by another rising of the wave of demand in a few weeks. This hope has not, however, been realized. The depression of business which set in last March and which seized all branches of trade and industry has lasted up to now and has only lately given way to a slight improvement.

The intervening time was one of great stress and considerable hardship to quite the majority of works. The foreign buyers kept away entirely and the inland demand dwindled to insignificance. Quite a large number of shops have not received a single order for more than four months. Even inquiries which would have brought encouragement if nothing else were missing. At the same time expenses continued to move upward in a steep line. The prices of materials kept rising from month to month, and after the workmen had received satisfaction as regards their wages, the whole force of employees claimed and obtained readjustment of their salaries, bringing the household expenses of a factory up to giddy heights.

Numerous Factories Offered for Sale

Not all of the German manufacturing firms weathered this storm with unimpaired strength and energy. The number of factories offered for sale in the papers was absolutely bewildering. A large firm of machine-tool dealers which was in the market for a workshop received no less than sixty replies to its advertisements from machine-tool firms, often of old standing. Numerous factories restricted working hours and some closed down entirely. Noteworthy among the latter is the case of the Maschienfabrik Oberschöneweide, formerly known as the German Niles works, which, in spite of its excellent financial connections and intimate relations to the Ludw. Loewe combine, went out of business. Its whole equipment has been bought up by a second-hand dealer. Only the pneumatic tool department will be continued in another shop. The large incorporated companies increased their capital or raised loans, but their smaller brethren went through financial difficulties. If these hard time should last much longer the effects would become still more marked. It is significant that the government has been earnestly occupied with forming plans for relieving the situation in the interest of the industry as well as that of the working classes. The situation for the latter has become very serious as the number of unemployed has increased rapidly.

The improvement which has shown itself lately, although very slight up to now, has been hailed with great delight. It coincides with the renewed drop of the German exchange. In so far it does not afford any satisfaction to the business world which would have wished an improvement independent of the exchange condition. This disappointment has, however, not been the only sore point of the situation. Even more serious is the fact that very few works have profited by the lesson dealt out by the hard times they have just gone through.

Depression Ascribed to Overstretching Prices

The cause of this depression has been commonly ascribed to an overstretching of prices. Thus all-round reduction seemed the only solution of the problem. Manufacturers were reluctant to take the consequences. Months of valuable time have been spent waiting for a return of the demand. When, however, no change for the better took place and the contracts ran out with no new orders coming in, the necessity for lowering the prices prevailed. It was not so difficult to reduce export prices. They have been put down from 3,300 per cent to a little over 2,000 per cent above pre-war prices. Great difficulty, however, was found to reduce the inland prices. The latter have on the average kept 40-50 per cent below export prices. It was commonly stated that these prices contained no profit but involved a considerable loss, which could only be borne by the compensation which the export prices afforded. In the absence of export orders the inland business means therefore an absolute loss. Firms able to sustain such a loss have stuck to their inland prices but many others had to reduce them considerably. A high-speed lathe of 190-mm. height of center (10-in. swing) and 1,000-mm. bed, which was sold in May at 46,000 marks, is now quoted at 33,000 marks. The same machine, 330-mm. height of center (17-in. swing) and 1,000-mm. bed was reduced from 101,000 marks to 78,000 marks. Lathes and drilling machines are most strongly affected by the slump. A radial drilling machine, which in pre-war time cost 3,000 marks, and which in April had gone up to 75,000 marks, is now sold at 50,000 marks. The prices of machine tools for inland consumption now average from eleven to fifteen times pre-war prices, or 20 to 22 marks per kilogram weight.

Situation Out of Manufacturers' Control

It is clear, however, that the price reductions made, in conjunction with the very serious need to sell at firm prices, will not bring such revival of business as is necessary to keep the industry employed. Manufacturers declare that the situation is out of their control. Without reduction of wages and of the prices of raw materials they are, so they say, unable to make further concessions. The annual report of the German Machine Tool Builders' Association for 1919, which has just been issued, gives strong expression to this view, which commonly prevails. There is, however, little hope that the desires of the manufacturers in the direction of reducing prime cost and expenses will materialize. The wages are at present about ten times higher than in peace times, but as they are still below those of other countries and have not increased in proportion to living expenses, the readjustment of wages and salaries can hardly be said to be completed. A reduction of the cost of raw material is quite out of the question. It is inconceivable where such reduction should come from. Germany before the war produced about 20,000,000 tons of iron, which was mostly gained from inland ore resources. It is estimated that now she has to import at least 6,000,000

tons of iron ore in order to keep up a fourth part of the pre-war production. Last year 6,500,000 tons of pig iron were produced, but only with the help of over 2,500,000 tons of scrap. There is still some scrap reserve in the country but it will soon be exhausted. Even this reduced production cannot be reserved for inland consumption, as the mills have to sell a part of their production abroad in exchange for foreign ore. The prices for raw material can in the future be not less than in other countries, but rather more, as the German iron and steel industry, dependent on import of ore and foreign shipping rates, will be seriously handicapped.

Reduction of Wages and Prices a Delusion

Under such conditions to expect relief from a reduction of wages and prices seems rather a delusion. The relief can only come from another direction. It points distinctly to higher economy of production and greater efficiency. In this respect much has to be done, and it is only surprising that so little has yet been done. It seems quite clear that when all the items which compose the household of a factory, materials, wages, power and other expenses are in the process of readjustment, the working methods and the equipment have to follow suit. The German manufacturers will no doubt in time—and after they have recognized that they cannot expect a reduction of wages and of cost of material—sit down and figure out how else they can reduce prices. They will then surely find out how much material can be saved in their designs and how wages and expenses can be kept down by more efficient labor-saving equipment. The time when this necessity will be recognized has not yet come.

Specialization and standardization, which are so much talked about as the harbingers of better times, are only a part of the great work of reconstruction, but even they are only in their first stages. Until the reconstruction and readjustment inside of the shops is seriously taken in hand, the German machine-tool industry will have to pass through very critical times and, as experiences show already, will not survive in full force.

Business Conditions in England

FROM OUR LONDON CORRESPONDENT

London, Oct. 22, 1920.

THE coal strike has started, bringing with it the possibility of a gradual close-down in British industry. Generally the position has been accepted, if not cheerfully, at least without undue complaining, and if the government is firm and fairly capable only one result can be predicted. It is at least possible that in social and economic matters Great Britain is entering on a transition period.

The idea of employment of men simply for the personal profit of the employer has long been a bugbear among the working classes, and Austen Hopkinson, a well-known engineering employer, was at least partly right last night in the House of Commons in ascribing low production to the fear of "making the boss a millionaire." But there are other reasons. The old idea of master and servant having gone by the board, new relationship may be instituted between employer and employed, profit-seeker and wage-earner. A share in the control of industry has been successfully claimed by labor. The trade unions have grown enormously in numerical strength and also greatly as regards funds, although in an absolute sense they may not be much stronger, if as strong, in the latter direction—the purchasing value of money having so heavily deteriorated. Now the trade unions and other organizations have pretty complete control of the situation and up to the present the government, claimed to be one of business men, has always acted with a view to compromising disputes for the purpose of "getting on with the job." This course of action was no doubt necessary during the war period. At the moment some slight change of policy suggests itself, as it has before. The government offer to the miners was in the nature of a face-saving character, as output had merely to be maintained and not increased to justify the advance in wages demanded and agreed to, with the reservation noted. But the offer was rejected very decisively. Of course the payment-according-to-output scheme suffers from some severe practical objections, as a strike or other dispute in a given district, whether justified or unjustified, would necessarily lower total output, and consequently the rate of pay of men in other districts who might or might not sympathize with the strikers. Even if the output were rated by districts or collieries in areas where seams have already been well worked the rate of output, rather than increasing, must necessarily decline. And to some extent the output must depend on the coal owners—they may or may not supply the most efficient colliery gear. In fact complaints in this direction are not uncommon. Most colliers here appear to favor a fixed payment per shift. The demand for reduction in the price of coal to the home consumer of 14s. 2d. a ton having been dropped, the miners' claim for their strike as unselfish disappears, and the dispute is merely one of wages. Much is said regarding control of industry but getting down to facts it is division of product that has caused disputes, so far.

The Banding of Interests

For several years now interests of all kinds have steadily banded themselves together. This is quite obvious in the case of labor where trade unionism is almost omnipotent, but it shows itself in many other directions and in small details. Thus part of the subsidy having just been withdrawn by the government, the price of bread as sold in the shops was necessarily raised. The ministry concerned there stated time after time that a reasonable price for the 4-lb. loaf is 1s. 3d. Nevertheless the shopkeepers—organized on a trade basis—insist on 1s. 4d., or 1s. 4½d. if delivered.

Individual effort beyond a limit is not encouraged in the ranks of the workers, the effort being toward a common uplift and a general rather than a particular raising of the standard of living. So far the process has met with success and, often when urged to it by government officials, employer and employed have sat down together to raise wages and prices and left it at that. Now apparently the limit has been reached and the consumer is refusing to make a demand. But not in all cases. Once again transport fares in London have been raised without any diminution in the number of persons traveling, but rather the contrary effect: the weather may of course be partly responsible. Beyond question however trade is declining as a whole and, apart from strikes, unemployment increases. The unemployed ex-soldier has been making himself heard, not in the pleasantest way, and a riot in Whitehall, preceded by a procession of unemployed, has forced the government to provide work or relief in the form of road-making, half the cost being placed on the London county rates, without the Council themselves, it would seem, being considered in the matter. The same is to apply elsewhere. Thus a further increase will be necessary on the already bloated local rates.

Selfishness Prevails

Selfishness prevails all round; in this regard no side can throw stones at another. For during the war the nation's interests were quite forgotten by the employed class, who were content to work on the so-called time-and-line plan. (Time and lime is held to be more correct, the phrase deriving from the building trades.) On this system the employer was encouraged to pay high wages, being then entitled to charge a corresponding profit. Everybody looked after his own interest and was apt to forget his duties. Workpeople are commonly blamed for demanding high wages, but they are not alone at fault. Their selfishness is simply more apparent.

Nowhere does it appear to be greater than in the building trades, where the demand for workmen is out of all proportion to the supply. For a period of years before the war men had been leaving these trades and by 1914 the number of bricklayers, for example, in this country had been reduced to about 74,000. At the moment the total is officially put at 53,000. Yet all attempts to ease the entry into these trades are definitely resisted and defeated, the excuse being that the housing demand may not last longer than ten years, when unemployment might again be experienced. Much cant is talked too by apologists for the building trades' workers in excuse for the notorious fact that, by means of bribes and similar payments, workers can with some readiness be found for luxury building, where officially permitted, while the building of houses for the working and similar classes is retarded or stopped for want of men. Withdrawal of labor is just as possible in connection with luxury building as with, say, a wage dispute.

Consumer Always Left in Cold

Still, the working men, and working women too, of Great Britain are closely joined together, and though the trade organizations are apt to have regard solely for the interests of their particular industry, the consumer always being left in the cold, yet co-operative action by the unions in regard to strikes is generally threatened, and by all accounts the railwaymen have issued an ultimatum to the effect that if the government does not in a given time take definite steps, of an obvious character, to end the dispute with the miners, they themselves will suddenly cease work. How far by this action they will commend themselves to the minds of the population generally does not appear. For the memory remains of last year's railway strike, with its attempt to hold up the food of the people. Further, the average person understands that before a railwayman can leave work he must give a week's notice. The transport workers, too, promise similar action—their secretary says "it appears better to widen the issue instantly and get the dispute settled in preference to allowing ourselves to drift"—although in this case a wages dispute has been in existence for some time and the strike is not necessarily one of sympathy only.

Meanwhile as regards coal, gas and electricity, supplies have been limited by orders, so that, for instance, no householder can receive more than 1 cwt. of coal a week, and then only on condition that he has less than 10 cwt. in stock, while the consumption of coal for factories, workshops and business premises is to be reduced to half, and gas produced at the gas works is not to have a greater calorific value than 450 B.t.u. per cu.ft. Illumination is being reduced, London's public streets approximating to the condition of the Zeppelin nights.

Short-Time Employment Grows

Directly or indirectly as a result of the strike, engineering and other works are discharging men, though the endeavor is rather to work short time, and thus spread employment as far as it will go. After four days it was estimated that 100,000 workpeople had been discharged and as the strike progresses so will unemployment, but up to a point at an accelerating rate. Apart from the strike, engineering and the iron and steel trades generally show further evidence of decline, but the collapses that have been so freely prophesied, more especially in the motor-car line, have not been announced. The stoppage of the Vulcan shops was for three weeks or so only. The closure of the Martinsyde works for a fortnight is indication of the condition of the aeroplane industry.

The report of E. G. Wrigley & Co., Ltd., Birmingham, manufacturers of automobile transmission gears and of twist drills and drilling cutters, for the year ending with April last is hardly exhilarating; it shows a loss of £144,000, attributed mainly to the molders' strike and then to difficulties of getting output large enough to cover dead charges. On the other hand, though not of course engaged in the same branch of engineering, Babcock & Wilcox, Ltd., the well-known boilermakers, are paying 7 per cent for the half year, free of income tax; or, in other words, 10 per cent, and this on a capital increased by half a million pounds, the increased distribution being £54,600 as compared with last year.

The Motor Pleasure-Car Show

The Commercial Motor Vehicle Exhibition, held at Olympia from Oct. 15 to 23, the most complete of its kind yet held in Great Britain, bore at the beginning every promise of success. It has been decided to proceed with the London pleasure-car show, to be held this year both at Olympia and the White City, from Nov. 4 to 13, though the banquet has been abandoned. The cycle and motorcycle show will be held at Olympia, W., from Nov. 29 to Dec. 4.

Recently, but before the miners' strike, more than 1,000 workpeople were discharged from the works of Steel, Peech & Tozer, Sheffield, and the reasons, as stated by A. Peech, are—apart from disputes—symptomatic of conditions here. The action was due to the fact that no orders were left for the particular section of the works concerned, one reason being that competition of Belgian and American material at lower prices is being felt. It is understood, too, that French steel makers have decided to make a special appeal to the British market: they are able to do this on price by reason of the present condition of exchange. The firm, in fact, calls for protection. The second reason mentioned is that confidence as regards capital is shaken by the continuance and increase of the excess profits duty. The third is: "The men never gave us the output they should have done. This combined with the abnormal rises in wages made it an impossibility to quote a firm price, so that a quotation accepted on the first of the month might have risen by 10 or even more per cent by the end of the month, and very considerably more by the time the order was completed and invoiced. Quotations, therefore, had to be given with reservation clauses, so that the purchaser never knew what price he was going to pay for the article he desired to purchase."

Gage Standards

The engineering world was recently astonished to receive notice from the National Physical Laboratory authorities to the effect that the absolute sizes of the accepted standard end gages had been found incorrect, the connection being proportional to the length and being at the rate of minus 12 parts in a million. Thus the accepted size of a 1-in. gage is reduced by 0.000012 in. This applies only to inch measures, not to metric units. The laboratory gave notice that as from Oct. 15 all gages would be tested on the new basis. A table has been issued showing the alteration which should be made in lengths hitherto accepted. It has been pointed out that the change is very small as compared with the change due to temperature-variation and that only where interchangeable parts for the same job have to be made by two different precision engineers is trouble likely to arise.

Shipbuilding Improving

Lloyd's Register here reports further improvement in the position of British shipbuilding relative to the rest of the world, the tonnage in the United Kingdom under construction at the end of last month being 3,731,098, constituting a record, which compares with 3,834,073 for the countries outside, excepting Germany, regarding which the figures available are incomplete. The falling-off outside the United Kingdom is quite covered by a decrease in the United States, a decrease also being reported from Canada, with increases in France and Holland. The output of the United Kingdom in the first three-quarters of the current year amounted to 1,448,435 tons, an increase of about 324,000 tons as compared with the same period of last year. The Clyde district has rather less than 950,000 tons on the way and Belfast rather more than 350,000 tons. The figures do not include war vessels.

In issuing their latest revised lists of standard rolled steel sections for structural purposes the British Engineering Standards Association suggests that on the occasion of the next revision the results of conferences with the American Engineering Standards Committee may be incorporated. The revised issue was adopted by the sectional

committee concerned toward the end of last year, but the American committee named requested delay in publication in order that the American steel industry might be consulted.' It appears however that nothing was possible by way of co-operation in the time available, but the British report indicates that "considerable progress toward Anglo-American agreement has already been effected."

The Cutlers' Feast was held as usual this year, on Oct. 14, in Sheffield in the hall of the Company of Cutlers in Hallamshire in the County of York, the master cutler being William Clark, director of the Sheffield works of Vickers, Ltd. American readers may be interested in the statement that this Cutlers' Company was incorporated in 1624, say 150 years before the United States was formed, while the feast was the 292nd of the series. It is often the occasion for political pronouncements.

American engineers who have visited Heathfield Hall, the home of James Watt—and they are quite a company—will regret to hear that George Tangye, who lived there so long, died on Oct. 7 last. Of the brothers who formed the Tangye firm he was the youngest, having been born in 1835. The story of the rise of this firm from a 4s. a week room has been told more than once, particularly as regards the hydraulic jack and the Weston differential pulley block, but it is not perhaps generally recognized that the firm in 1862 introduced a steam engine with interchangeable parts. Mr. G. Tangye had been chairman of Tangyes, Ltd., since 1906 when Sir. Richard Tangye died. When the old Boulton & Watt firm was sold out he secured the collection of drawings and other relics of the two men named, and of Murdoch and many others, that had been made by W. H. Darlington, and he housed them in part of the Soho works which was and is devoted to machine-tool production, this until the local authorities had provided special rooms in the Municipal Reference Library, Birmingham, to which the relics were removed in 1915. Heathfield Hall, and particularly the garret workshop of Watt, could generally be visited by the favor of Mr. Tangye and last year, on the occasion of the centenary celebration, a large party was thus entertained by him. He had a particularly ready welcome for American engineers. An effort is being made to secure the garret workshop at least as a memorial of Watt.

New Regulations Affect Trade With Italy

IMPORTERS in the United States of Italian commodities will be interested in the announcement recently made by the Italian Chamber of Commerce in New York to the effect that, hereafter, American Consuls will issue consular invoices for exports from Italy to the United States on the quotations of the gold exchange which the Italian Government establishes for the payment of railroad tickets sold abroad or involving a trip beyond the boundaries of Italy.

The chamber states that its plea to the United States Treasury Department has been successful, and that the Treasury has agreed to discontinue the valuation of the gold lira at the rate of two paper lire for the satisfaction of custom duties, and to adopt the actual gold exchange instead.

The following letter, dated Oct. 7, was received by the chamber from J. D. Nevins, acting chief, division of customs:

> The department refers to your letter of Aug. 12, further in regard to the use of Form 144 by American consuls in Italy. The executive order of Nov. 13, 1919, requires in such conditions as exist in Italy that Form 144 must be used. However, as it appears that the rate established by the Italian Government for the collection of custom duties is more or less an arbitrary one, the department has decided to discontinue the use of such rate. Under today's date, the honorable Secretary of State is being requested to instruct American consuls in Italy to continue the use of Form 144, but, instead of using the customs rate as heretofore, to now use the Italian railways rate which is based on a gold standard and approximates the relative values between the lira and United States money.

In explanation of the new ruling, the Italian Chamber of Commerce in New York issued the following statement:

> This means that the American consuls will now issue consular invoices for exports from Italy to the United States on quotations of the gold exchange which the Italian Government establishes for the payment of railroad tickets sold abroad or involving a trip beyond the boundaries of Italy, which tickets are payable in gold lire, otherwise in paper lire at the exchange fixed by the government itself taking as a basis the quotations of the principal stock exchanges of the kingdom.
>
> The Italian Chamber of Commerce in New York is now endeavoring to protect shipments on their way to the United States for which currency certificates of depreciation have been issued under the rule now discontinued, that is, at a value of two paper lire equal to the value of one gold lira.
>
> The chamber has suggested to the Treasury Department that the collectors of customs at the several ports throughout the United States be authorized and directed to permit entry upon proforma invoice with bond for the production of the consular invoice or the replacing of the one already filed and to accept as a deposit at the time of entry the amount of duty based upon the Italian railways rate, as now fixed upon. The chamber had the opportunity of stating in a letter to the Treasury Department under date of Sept. 28, that to require the importer to deposit duty based on 9½ or 10 cents per lire would be unjust, in that it would mean to collect duty not on real and true value of the goods, but on the fictitious value, and it would also tie up double the actual amount of duties, through no fault of either the shipper or the importer.

Italian-American Trade for August

During August, the United States imported from Italy goods to the value of about $5,390,000, which is about $1,435,000 less than in August, 1919. The exports from the United States to Italy during the same month amounted to about $18,000,000 as against $28,500,000 in the corresponding month of the preceding year.

The total value of the domestic exports of machinery, during August, from the United States to Italy was $249,555, divided as follows: Textile machinery, $84,519; lathes, $1,999; other machine tools, $63,514; sharpening and grinding machines, $24,726; all other metal-working machinery, $54,456; excavating machinery, $18,400; air-compressing machinery, $346.

Increases in Italian Import Duties on Motor Vehicles

In order to equalize the differences which have heretofore existed between the low Italian duties on motor vehicles and the high tariffs imposed on these vehicles by Great Britain, United States, and France, the Italian Government has decreed substantial increases in rates, the same having become effective Sept. 15, 1920.

Passenger automobiles (with or without bodies), trucks, traction engines (including farm tractors), motor-driven street-cleaning apparatus, and motor fire-engines now pay the following duty in gold per quintal:

	Lire
Weighing not more than 400 kilos	20
Over 400 kilos up to and including 900 kilos	115
Over 900 kilos up to and including 1,600 kilos	65
Over 1,600 kilos up to and including 2,500 kilos	75
Over 2,500 kilos up to and including 4,000 kilos	95
Over 4,000 kilos	60

Automobiles, with or without bodies, weighing not more than 2,500 kilos pay also a surtax of 35 per cent ad valorem. Automobile bodies are classified as automobiles. On automobile parts the following new tariff, gold per quintal, is in force: Frames, 70 lire; gear shifts, 110 lire; rear axles, complete, 90 lire; all plus a surtax of 30 per cent. ad valorem.

The restricions on the importation of automobiles have been continued largely because of the inadequacy of the old duties, but in the near future the increases in the tariff should result in the removal of these restrictions, or at least, in their modification.

Italian treasury receipts for August, 1920, amounted to 877,544,066 lire, as compared with 682,796,669 lire for August, 1919. This is an unusually large increase. The detailed statistics reveal that all items show an increase, with the exception of indirect taxes on consumption. The figures are:

Item	August, 1919 Lire	August, 1920 Lire
Direct taxes on incomes	370,011,482	444,443,730
Indirect taxes on consumption	95,751,199	88,053,361
Taxes on business and profits	71,511,022	104,922,250
Industrial monopolies and lottery	143,345,675	220,636,101
Commercial monopolies	2,177,290	19,498,624
Total	682,796,669	877,554,066

Despite the unsettlement which was brought about by the recent series of labor troubles in Italy, security prices in general on the Italian stock exchanges have held up in a surprisingly firm manner.

A bill providing for the abolition of certain Italian trade restrictions was passed recently by the chamber of deputies. The measure among other things, will limit the activity of the government in the production and distribution of goods, permitting the largest freedom possible under existing conditions; and will result in the infliction of heavy penalties for those convicted of profiteering in articles of prime necessity.

The supply and distribution of newsprint paper, cotton, wool, and other textile materials will be taken from the hands of the government, and the stocks of those commodities on hand will be delivered over to the co-operative associations which will dispose of them under government regulations; the newsprint supply, however, being still below the demand, the necessary regulations for assuring a steady supply to the press and for preventing a "corner" in the market will be issued by the ministry of industry and commerce, which agency, however, will not continue to exercise the direct control which it has been exercising over production; the office controlling the manufacture and distribution of "national" shoes will be abolished.

Within three months from the date on which the law becomes effective, the list of commodities of which the importation or exportation is subject to restriction shall be revised and a number of such commodities taken from the restricted list.

It is also provided that merchants who enter into agreements fixing prices or limiting the quantity of goods to be offered on the market are liable to penalties established by a new law on profiteering, namely, imprisonment for from one to five years and a fine of 1,000 lire or more. The hoarding of food products, raw materials, or other necessary goods, or their withdrawal from their course toward normal consumption, is made punishable with imprisonment up to five years and a fine of more than 500 lire.

Because of the decline in the cost of food and the expectation that other commodities would also show a price recession, the *Navigazione Generale Italiana* has decided to abandon the proposed increase of $15 in the minimum cabin rates to Italian ports, which was to have gone into effect on December 1. Some of the other lines operating between New York and Italy, it is understood, have determined upon the same course.

What Is a Machine Tool?

BY ENTROPY

In some ways it seems as though the discussion regarding this definition had gone to lengths not entirely justified by its comparative importance, but on the other hand it has developed the fact that there is a difference of opinion. An analysis of the situation may help us to agree on a proper limitation of the term.

There are two distinct classes of names; those which are descriptive and those which are arbitrary. A street may be named "Elm Street" because it is lined with elm trees, and the name is descriptive. It may be called "Sixteenth Street" and the name is arbitrary, but also directive because the name in itself assists the person who wishes to find it. In olden times people named a boy Rufus, meaning red, if he showed signs of having red hair. Today the name is simply a name and not more descriptive than John or James. So with other names, they may have had a meaning once which was descriptive and therefore an assistance to the inquirer, but now they are entirely arbitrary.

No one has definitely traced the term "machine tool" to its lair. It may have come about through a contraction of the term "a machine to drive a tool," or "a machine to guide a tool." As a matter of fact there seem to be more people who really look on it in that light than otherwise. A lathe may come under that head or not as one looks at it. An engine lathe, or a bench lathe usually does so. A speed lathe used for polishing does not, unless we stretch the term tool to include emery cloth. If we stretch it, as most correspondents seem willing to do, to cover a grinding machine in which the tool is a grinding wheel, then it would take little more stretching to make it cover a machine in which emery cloth or even loose emery was the cutting tool. The guidance part of the definition may be limited to the guidance of the material worked on, as in the polishing lathe where the work is constrained to revolve on centers; or it may be a complete guiding of both work and cutting tool as in a planer or milling machine. A speed lathe using hand tools is less surely a machine tool by virtue of the lack of definite guidance of the cutting tool. Its classification as a machine tool is justifiable, however, because it is so closely related to an engine lathe. The definition safely includes presses using dies and punches which cut and thus shape the material but would not include forming presses except by a similar analogy to the speed lathe. It should not necessarily include a sewing machine because there is no cutting away of the material sewed.

It would however include all kinds of woodworking machinery, which is not usually classified under this heading. If we want to make the definition agree more closely with custom we can specify that the machine tool is specifically for cutting metals. However, many machines made for that purpose are equally useful for cutting fiber and other non-metallic substances. It is likely that manufacturers of woodworking machinery would rather use that very descriptive term and would prefer not to have their product included under the name of machine tools.

The important point in this, or any other definition is to make the term sufficiently descriptive so that no expensive harm may come to any one who uses the term in a common sense way. If the term "machine tool" is used in ordinary correspondence there is little or no danger of misunderstanding, for a man does not order a dozen "machine tools" but he orders and corresponds about specific machine tools. It is only in cases where these different machines are grouped together for some purpose that harm can come. For example: for purposes of taxation, insurance, and other grouping made by people not in the industry there is apt to be a class of machines called "machine tools." It is this sort of classification which makes a rigid definition necessary in order that there shall be no misunderstandings. For this reason the narrow definition "a machine for guiding and driving a cutting tool, primarily intended for use on metal," may be the best for the simple reason that it does include a class of machinery used in a rather definite type of shop. To be sure those shops may also use wood-working machinery, but the whole atmosphere and methods of a woodworking shop are so distinctively theirs that it seems as though a separate classification were justifiable, and it is doubtful if any serious harm could ensue from their being classified together.

SPARKS FROM THE WOR

Valentine Francis

General Electric Employees Given Chance to Buy Stock

The General Electric Co. is offering to employees who have been on the payroll continuously since Sept. 1, 1920, the privilege of subscribing, during November, for from one to ten shares of capital stock at $136 per share. A credit is to be allowed amounting to $20 per share which will represent a net return substantially the same as that which would be enjoyed by anyone purchasing stock on an installment plan, paying interest on deferred installments and receiving cash and stock dividends. Certificates of stock are to be issued to the subscribers when payments amounting to $116 per share have been made.

Payments must be made by deductions from salary or wages, in monthly or weekly installments, as subscriptions may not be paid up in advance. No deliveries of stock will be made previous to the payment of the first installment. The total time over which the payments are to extend is 29 months or 116 weeks.

Arrangements are made to reimburse, with interest at 7 per cent, subscribers withdrawing before making final payment, also for reimbursing subscribers leaving the employ of the company, those temporarily absent because of illness or layoff and those relieved on pension. Employees are under no obligation to make subscription.

That all questions arising under the plan described are to be decided by the board of directors of the General Electric Co., is one of the conditions upon which subscriptions are received.

Shipments of American Locomotives Show Large Gain

In the first eight months of this year the United States exported 1,150 locomotives to all parts of the world, nearly 200 more than in all of last year and more than twice as many as normally exported annually before the war, it is shown by the National Bank of Commerce in New York in the November number of its magazine, *Commerce Monthly*. The largest purchases this year have been made by Belgium, Italy, France, Poland and Danzig.

Representing a rather large outlay of capital, locomotives are bought in quantity only as a definite step in the rehabilitation or extension of railroad lines. A country imports rather than makes its locomotives either because it has not highly developed its manufactures or, as in the case of France, because its manufacturing has been so disrupted by war that domestic manufactures cannot supply its needs.

Before the war the export of locomotives was concentrated in the hands of the great steel-producing countries—Great Britain, Germany and the United States. Under these circumstances American sales to Europe were very small. During the war, however, the United States was called upon to supply locomotives to Europe, and in 1918 even sent 241 to England. Since the close of the war the United States has been the only country prepared to ship locomotives in quantity, and the exports from this country form the chief part of the international trade. As time goes on, British competition may be expected again to become an important factor in the trade, and Canada has also entered the field as a locomotive exporter.

Further Additions to the F. A. E. S.

The interest being taken by engineering societies in the Federated American Engineering Societies is indicated by the number voting to become charter members. The latest activities of the F. A. E. S. follow:

The Engineering Society of York at its meeting on Oct. 18, 1920, unanimously adopted a resolution to apply for charter membership of The Federated American Society of Engineers.

The Washington, D. C., Society of Engineers voted at its meeting on Oct. 20 to become a charter member.

D. J. Sterrett has been appointed a delegate to represent the Detroit Engineering Society at the first meeting of American Engineering Council, to be held in Washington, D. C., Nov. 18-19.

The Buffalo Engineering Society has appointed President W. B. Powell a delegate to the first meeting of American Engineering Council.

Corporation for Direct Selling Proposed

It is proposed by L. S. Devos, an export manager with offices in the Grand Central Palace, New York, to form a business corporation, the objects of which would be to centralize through one channel the export business of its members; to maintain direct selling representation in the New York metropolitan district; to maintain direct selling representation in foreign territories; to appoint proper representation in foreign territories where the amount of business would not justify direct selling; to maintain in foreign districts service men of the members of the corporation; and to centralize through one channel for all members purchasing, advertising, domestic and foreign sales, forwarding and shipping.

Mr. Devos is export manager for the Foster Machine Co., Stockbridge Machine Co., Giddings & Lewis Machine Tool Co., Cincinnati Lathe and Tool Co., American Milling Machine Co., U. S. Machine Tool Co., U. S. Drill Head Co. and Otto Grinder Co.

A meeting will be held on the evening of Nov. 10 at the Hotel Astor.

Co-operative Meeting on Steel Industry Working Shifts

The Taylor Society, described as a society to promote the science and the art of administration and management, will hold a co-operative meeting on Dec. 3 with the metropolitan and management sections of the A. S. M. E. and the New York section of the A. I. E. E. This meeting will be held at the Engineering Societies Building, New York.

Horace B. Drury, formerly of the economics department, Ohio State University, and recently with the industrial relations division of the U. S. Shipping Board and besides author of "Scientific Management" (Longmans), will read a paper on the subject of "The Three-Shift Day in the Steel Industry."

During recent months Mr. Drury has visited practically all of the steel plants in the United States working under the three-shift system in an effort to collect technical data covering the details of their operation and figures showing the results obtained. Mr. Drury's paper will be a general review of his findings and will constitute the first comprehensive contribution on this important subject to American engineering literature. Throughout industry there is a steadily growing tendency to shorter hours. In Great Britain, France, Belgium, Sweden and practically all important steel producing countries the three-shift day has very largely superseded the long two-shift day in the steel industry. It seems probable the three-shift system will come in America and it is the part of conservatism and wisdom for management to prepare for it.

"The Long Day in the Steel Industry," and "The Point of View of the Manufacturers" will be other subjects discussed. William B. Dickson, vice president of the Midvale Steel and Ordnance Co., will read a paper on the latter subject and a general discussion to be led by Robert B. Wolf, consulting engineer, New York, will follow.

LD'S INDUSTRIAL FORGE
News Editor

New Officers and Plans of the A. S. M. E.

Edwin S. Carman, manufacturer, of Cleveland, has been elected president of the American Society of Mechanical Engineers in a mail ballot covering a membership of 13,000, comprising engineers, managers and technologists in every industrial center of the country. Mr. Carman succeeds Major Fred J. Miller of New York, and will take office after the society's annual convention, to be held in New York in December.

John L. Harrington, consulting engineer, of Kansas City; Leon P. Alford, editor, of New York, and Robert B. Wolf, president of the R. B. Wolf Company of New York, were chosen vice-presidents for two years in succession to John A. Stevens of Lowell, Mass., Henry B. Sargent of New Haven, Conn., and Fred R. Low of New York. Three managers, each for a term of three years, were elected as follows: Henry M. Norris of Cincinnati, Carl C. Thomas of Los Angeles, and Louis C. Nordmyer of St. Louis. Major William H. Wiley, publisher, of New York, was re-elected treasurer. The secretary will be elected by the society's council in December. Calvin W. Rice has held this office since 1906.

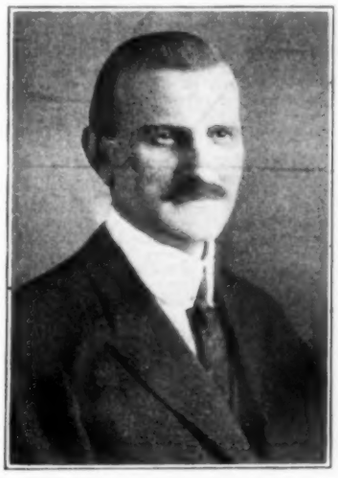
Following a meeting of the society's council, composed of the president, vice-presidents, managers, past presidents, treasurer and secretary, plans for promoting professional endeavor and public service, particularly as to industrial relations and rewarding engineering achievement, were announced. The finance committee recommended a budget for the ensuing year of more than $500,000. The publication committee reported that the society's publication for the year had involved an expenditure of more than $200,000.

The meetings and program committee detailed plans for the December convention and also announced plans for a congress of mechanical engineers to be held in Chicago next spring.

The engineering foundation fund for engineering research, of which the society is one of the sponsors, will shortly amount to $1,000,000. This fund was established in 1914, by Ambrose Swasey of Cleveland, by gifts to the United Engineering Society, as a nucleus of a large endowment "for the furtherance of research in science and in engineering or for the advancement in any other manner of the profession of engineering and the good of mankind." The fund is administered by the engineering foundation board, composed of members from the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers and the American Institute of Electrical Engineers.

John H. Barr of New York, formerly professor of machine design at Cornell, was appointed the society's representative on the national research council for three years, succeeding W. F. M. Goss of New York. Fred J. Miller, retiring president, was named to fill the vacancy on the John Fritz medal board created by the death of John Alfred Brashear of Pittsburgh, a past president of the society. Mr. Miller will serve until 1923.

The council adopted a recommendation from a special committee on industrial engineering, composed of Dean D. S. Kimball of Cornell, chairman; L. W. Wallace of Baltimore, and L. P. Alford, Frank T. Chapman, and Robert W. Wolf of New York, that immediate steps be taken "to formulate a practical program of industrial relations which will express the viewpoint and beliefs of engineers." The management section of the society was charged with carrying out a plan submitted by Dean Kimball's committee, providing that a committee on agencies of productivity be established to study invested savings, credit capital, organized labor, unorganized labor, employers, managers, society as a whole, economic and productive intelligence service. The committee requested the council to call upon the society's membership for active assistance "in building up a co-operative movement between all organizations which are working for the improvement and upbuilding of industry."



EDWIN S. CARMAN

The council adopted a report as to a system of awards and prizes for meritorious contribution to the science and art of engineering by a committee on awards and prizes headed by Dr. Ira N. Hollis president of Worcester Polytechnic Institute. Among the awards which may be granted by the council in recognition of distinguished service to engineering and the industries are honorary membership, life membership for the best contribution to the literature of mechanical engineering appearing in the society's publications for a given year, a medal for some notable invention or striking improvement in connection with the industries, and honorable mention, appearing as a diploma for such inventions or improvements in engineering as in the opinion of the council merit the attention of the society without being of such far-reaching importance as to warrant a medal.

Awards of scholarships or fellowships for exceptional attainment in college work, the report stated, are under contemplation. Other awards include a junior medal or cash prize for the best paper or thesis submitted by junior members and two student medals or cash prizes for the best papers or thesis submitted by student members of the society. All awards are granted by society's council, which holds about seven meetings a year in New York and other centers. The council is aided in preliminary decisions by an executive committee and by an elaborate organization of standing committees in charge of fundamental activities.

The society has formed an aëronautic section with a large membership, including Orville Wright, Howard E. Coffin, Edward A. Deeds, Jesse G. Vincent and Elmer A. Sperry.

Crane Co. Registers in Thirty-One Countries

Thirty-one countries, necessitating ninety-three separate registrations, have been chosen by Crane Co. in which to protect its three trade marks.

The Crane Co., a Chicago institution, was established in 1855. It is its business to manufacture some twenty thousand different articles more or less closely associated with pipe and piping, and to distribute, as merchants, numerous other manufactured articles.

Soon after the orders had been forwarded to the thirty-one countries, it was discovered that "piracy" of the trade mark "Crane," had developed in a South American republic. Hope is expressed that the applications for these foreign registrations will have been filed in time to forestall the work of the "pirates" in all of the countries entered.

German Import Restrictions on Machine Tools

The German branch of the National Cash Register Co., which up to now had only a shop for repair work and assembling, is now planning an enlargement of its workshops for the purpose of manufacturing

The firm intended to equip its new shops with American machine tools and had applied for a license to import a number of such tools. This license has, however, been declined on the ground that similar tools are being made in the country. This decision has evidently been made to enforce the American company to buy German machine tools.

German firms applying for import licenses for American machine tools have obtained them without great difficulty. It is, however, necessary for the buyer to state that he cannot obtain tools of the same kind and quality in Germany.

Machine-Tool Market in Bolivia

In the near future there is likely to be an increased demand for machine tools in Bolivia, but in considering the needs of this market it must be borne in mind that the tools will be required for repair and general work.

Tools designed for quantity production, except small automatics for turning out studs, small bolts and nuts, are not, and for some time to come will not be, wanted, and it will be useless tc attempt to push their sale. At the same time makers will be well advised to send out well-illustrated catalogues, printed in Spanish, describing as far as possible in non-technical language some of the more elaborate of their productions, solely with a view of driving home to the Bolivian user the fact that they can and do make giant machines which are in every way superior to the productions of United States shops. There will be no sale for these, but there will be a large advertising value in such distribution.

Mining Requirements

By far the greatest proportion of machinery imported into and used in Bolivia is intended for mining or closely related purposes. If railway rolling stock, which accounts for about 25 per cent of the total value of the machinery sent into the republic, is left out of consideration about 22 per cent of the balance is mining machinery, and the rest is spare parts, engines, electrical appliances and machine tools used in connection with mining.

The machine tools required are consequently those which can be used in the repair of crushers of all kinds, crushing rolls, stamp mills, tube and ball mills, pulverizers, mechanical roasters, jigs of various makes, concentrating tables, flue vanners, classifiers and mechanical separators. Tools are also wanted which can duplicate parts of Diesel and semi-Diesel oil engines, turn up commutators of electric motors and generators, deal with broken parts in compressed air drills, air compressors, pumps, mining cars and small locomotives used for hauling ore and other purposes. There is just now a fair and increasing demand for hydraulic and dredging machinery, and tools capable of dealing with repairing and duplicating parts of such machines will be wanted.

Repair Shop Equipment

In addition to the shops connected with the various mining establishments and railways there are a number of privately owned repair shops, most of which were equipped with machine and other tools of German or United States origin. Most of these contemplate the installation of new plant.

Recently motor-car repair has been undertaken, and there is a fair inquiry for machine tools for grinding cylinders and other parts, for gear-cutting and hobbing machines, and incidentally for electric and oxy-acetylene welding outfits. Small electric furnaces for the heat treatment of tools and steel parts are also likely to come into request.

The average repair shop in Bolivia will contain the following equipment:

One medium lathe of ordinary belt-driven three-cone pulley type, with back gear and screw-cutting banjo plate and wheels, for metric as well as other threads. This will be of 12-in. or 16-in. center, with gap to allow of work up to 36 in. being taken, and with a bed length of about 10 ft. Such a machine must be large enough to take the crankshaft of an ordinary traction engine, or to turn up a medium length of countershafting.

One lathe of 9-in. center with gap and bed about 6 ft. 6 in. in length, sliding and surfacing, with ordinary tool rest, three-cone pulley, and back gear.

One lathe of 5-in. center, with gap which will permit of pulleys about 18 in. in diameter being faced and bored. Self-traversing ordinary tool rest and bed about 3 ft. in length.

One high-speed radial drill to take up to 2-in. hole in cast iron, preferably with hand feed. The spindle should be capable of taking chucks to hold drills of very small size as well as the bigger drills. The bed should be such that the machine can take ordinary steel girders. In addition to this big drill there will usually be a smaller radial drill and two or three high-speed drilling machines of the pillar type, and a hand-power bench drilling machine with medium heavy flywheel.

One shaping machine with rising and falling table, adjustable head, quick return motors, and capable of at least 12 in. travel. In addition there may be a small high-speed shaper and a 30-in. planing machine, the French type of this tool being preferred.

A medium-sized miller, one small power grinding machine, a small saw-grinding machine, one power-driven punching and metal-cutting machine, and two or three small hand-operated punching machines.

—*London Times.*

Manufacturers' Sales Co. Organized

The Manufacturers' Sales Co. has been organized. with offices in the Leader-News Building, Cleveland, Ohio, to represent in Cleveland and surrounding territory, one or possibly two large reliable manufacturers for the sale of their respective products.

C. C. Bradford, for a number of years sales manager of the U. S. Light & Heat Corporation and more recently sales manager of the Marlin Rockwell Corporation, has been selected to manage the affairs of this new enterprise. Mr. Bradford is widely acquainted among manufacturers and buyers throughout the Middle West and has had extensive experience in developing large sales organizations.

Kansas State College Makes Lathes for High Schools

Two sets of lathes made in the shop practice department of the division of engineering of the Kansas State Agricultural College were shipped out during September, one going to the board of education at Alton and the other going to the board of education at Clyde.

The department has been building wood lathes as a part of the regular class work for engineering students. Sixteen of these have been in use since 1917 in the woodturning and pattern shop.

During this period the lathes have been closely inspected for weak places. As soon as any weak point was discovered it was corrected and the changed part thoroughly tried out to be sure no weakness would result.

The lathes are mounted in pairs on a substantial stand and are driven from underneath. The moving parts are all enclosed except the spindle on which the work is mounted. This insures "Safety First," as all shifting of belts is done by simply shifting a lever.

Lathes Made Interchangeable

The method used in the college shops in making these lathes is practically the same as those used in commercial shops. Jigs, fixtures and gages are used to insure all parts being interchangeable. This means that the college can furnish parts for the machines in case they are broken or wear out in use with the assurance that the parts will interchange with the old parts. The parts which go to make up the machine are numbered in such a way that no difficulty is experienced in ordering any part that should be needed.

The shop-practice department secured from the war department a large assortment of up-to-date machine tools for the machine shop recently.

With the use of the new machinery it will be possible to turn out a much greater number of pieces than was formerly possible and within the next year there should be quite a number of these lathes available for use in high schools and other schools in Kansas, the plan being to supply them in units of two or more mounted on a very substantial bench in such a way that they can be readily attached to a motor, or a gas engine, or a line shaft. The college supplies the lathes at a price that approximates the actual cost of materials used in their construction.

Decline in Shipbuilding

According to figures of the Bureau of Navigation private American shipyards on Oct. 1 were building or under contract to build for private ship owners 331 steel vessels of 1,236,277 gross tons, compared with 345 vessels of 1,236,547 gross tons on Sept. 1, 1920.

These figures do not include government shipbuilding or contracted for by the United States Shipping Board out of money voted by Congress.

Southern Commercial Congress' Progress in Export Trade

In order to form commercial alliances with foreign business concerns, principally with companies located in Latin-America, and thus to further expand and broaden the foreign market for Southern industrial concerns, manufacturers, business men and bankers of Atlanta are planning the organization of the Atlanta Export Club. This club will be the result of the recent training school for Pan-American Commerce, conducted in Atlanta under the auspices of the Southern Commercial Congress, and widely attended by business men and manufacturers of the Atlanta trade territory. The course was intensified into a month's training, covering the most important phases of foreign commerce, and under the direction of men long experienced in this field.

During the past two or three years the expansion and growth of foreign trade between Southern industrial centers and Latin-American countries has been remarkable, the principal products now finding a market in those countries being machinery, machinery supplies, machine tools, and iron and steel products. It is the purpose of the Southern Commercial Congress to further increase this trade by the establishment in various industrial centers of the South of inland consulates, in charge of men experienced in foreign commerce and familiar with the trade conditions in the countries they represent.

That this plan is the most feasible is indicated by the enormous amount of export trade now carried on between Atlanta and Cuba and Atlanta and Panama. Both of these countries are represented in Atlanta by consuls who devote a large part of their time to the development of this business. Dr. Guy King represents Cuba, and John Ashley Jones, Panama.

These two countries, the consuls say, offer at this time a very fertile and stable market for machinery and machinery products of almost any kind, and machine tools. The same is true of Peru, Brazil and the Argentine, and efforts are being made by the Southern Commercial Congress to have all of those countries establish consulates in the inland cities of the South.

France Reorganizes Foreign Trade Bureau

The "Office du Commerce Exterieur" of France, although bearing the name of a bureau that has been in existence for some time, has recently been reorganized on a more ambitious scale. This department of overseas trade is a practical link between official France and the general public at home and abroad. It is now aided on the financial side by the new Foreign Commerce Bank. It controls the service of French commercial agents, and is responsible for organizing trade exhibits in France and other countries.

The department supplies trade information in the form of loose-leaf pamphlets, or in response to verbal and written inquiries, and at the same time welcomes the opportunity of helping foreign traders seeking information as to the French market. The department will soon begin the publication of a periodical similar to the British Board of Trade *Journal*.

The commercial exhibition plans include at the present time a "touring fair" for Canada, the Colonial exhibition at Marseilles in 1922, and an inter-allied exhibition which is planned to be held in Paris in 1925. Permanent exhibitions are being provided for branch offices of the department in the principal countries of the world. These exhibitions have already been opened in Spain, Switzerland, Czecho-Slovakia, the Balkan States and in London.

Kelly-Reamer Changes

Coincident with moving into its new plant, the Kelly Reamer Co., Cleveland, Ohio, has made the following changes:

A. H. HOWARD, formerly operating an independent office as the A. H. Howard Sales Engineering Co., has joined the organization, and will represent the company in Cleveland, Toledo and northern Ohio territory.

R. W. MARTINDALE, formerly with the E. A. Harper Tool and Supply Co. of New York and Philadelphia, will handle the Pittsburgh territory.

W. B. LEONARD, formerly connected with the Standard Tool Co., will handle the Buffalo territory.

New Officers of Cost Engineers of Indiana

D. E. Nauman, of the Midwest Engine Co., was elected president of the Association of Manufacturers Cost and Efficiency Engineers of Indiana at a dinner meeting held at the Hotel Lincoln, Indianapolis, recently.

Other officers named were H. J. Wilson of the Warner Gear Co., Muncie, vice-president; G. F. Buxton of the vocational education department of Indiana University, secretary, and D. M. Milholland of the Milholland Machine Co., treasurer.

R. A. Mouron, statistician of the Nordyke & Marmon Co., spoke on "Graphic Presentation of Business Control," illustrating his talk with a number of interesting and instructive charts.

Appreciation of Long and Faithful Service

On November first the Watson Stillman Co., Aldene, N. J., presented to Thomas Watson, a machinist who has been continually in its service for fifty years, a gold watch suitably inscribed and a check for one thousand dollars in appreciation of his loyal and faithful service.

At the same time, Wm. Graudorf, T. W. Hammond, A. D. Carnes, J. Hardy, Wm. Koshwitz, Wm. Meily and C. J. Wessels were each presented with a gold watch and Carl Wigtel was presented with a watch fob; all in recognition of long and faithful services.

Clark Equipment Co. Has New Motor-Truck Axle Plant

The new Battle Creek plant of the Clark Equipment Company of Buchanan, Mich., which has been under construction since March 1, is almost completed and the work of "tooling up" the plant for the manufacture of Clark axles will soon be in progress. Much of the machinery has been purchased and is ready for installation. This plant of the Clark Equipment Co. will be used exclusively for the manufacture of Clark motor-truck axles.

The plant's site comprises twenty-three acres with a 4,600-ft. frontage on the main line of the Michigan Central Railroad and a smaller frontage along the Grand Rapids and Interurban Railroad. It is located on the extreme western side of the city. The manufacturing building is 99 x 440 ft. and a warehouse parallel to it is 50 x 144 ft. The two buildings are connected by two closed passageways. A third building houses the power plant.

All sales, engineering, purchasing and general administration will be handled as before through the general offices at Buchanan, Mich. There will also be put into force at the Battle Creek plant the same progressive policies of plant management and profit sharing, which have proved so valuable at Buchanan.

J. J. Arnsfield Elected President of Engineering Advertisers' Association

At a recent meeting of the board of directors, J. J. Arnsfield, advertising manager of Fairbanks, Morse & Co., was elected president of the Engineering Advertisers' Association of Chicago to fill the vacancy made by the resignation of A. H. Hopkins, who severed his connection with the C. F. Pease Co. to take charge of the domestic advertising division of the J. Roland Kay Co. Keith J. Evans, advertising manager of Jos. T. Ryerson & Son, was elected vice president, and Julius Holl, advertising manager of Link-Belt Co., was elected to the board of directors to fill the vacancy made by Mr. Hopkins' retirement.

Metal-Working Machinery Exports for September, 1919 and 1920

Exports of metal-working machinery fell off slightly in September, 1920, as compared with the exports of September, 1919. The figures, as compiled by the Bureau of Foreign and Domestic Commerce, are as follows:

METAL-WORKING MACHINERY EXPORTS FOR SEPTEMBER

	1919	1920
Lathes	$724,960	$506,781
Other machine tools	841,956	1,176,175
Sharpening and grinding machines	313,581	333,844
All other	1,991,005	1,190,343
Total	$3,871,502	$3,207,143

New Safety Club

The Syracuse Safety Engineers' Club was organized last week as an adjunct of the Syracuse Safety Council of the Chamber of Commerce.

Personals

P. Z. VERNON, of Alfred Herbert, Ltd., who arrived in New York on Sept. 9 for a few weeks to familiarize himself at first hand with conditions in the United States, has recently returned to England.

J. M. HENRY has been transferred from the position of assistant research engineer of the Pratt & Whitney Co., Hartford, Conn., to the publicity department of the Niles-Bement-Pond Co., New York. He will also have charge of the publicity connected with the Pratt & Whitney Co. products.

J. B. PETERSON, formerly with the Bureau of Standards, Washington, D. C., is now in the production department of the Royal Typewriter Co., Hartford, Conn.

HERBERT A. CARHART has resigned as assistant superintendent of the Lincoln Motor Co., Detroit, and organized the firm of Carhart Bros. Foundry, Inc., Syracuse, N. Y., producers of gray-iron castings for textile machinery and other light medium machine parts. Mr. Carhart is president and manager of the new firm.

O. P. PALMER, purchasing agent of the Pratt & Whitney Manufacturing Co., Hartford, Conn., was elected president of the Connecticut Purchasing Agents' Association, at a recent meeting.

BENJAMIN L. COE, treasurer of the Steel & Johnson Manufacturing Co., Waterbury, Conn., has recently been chosen president of the West Side Savings Bank of Waterbury, Conn.

GLEN R. ANDERSON has recently entered the Pacific Coast sales organization of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass. Mr. Anderson will cover the district in and about the City of Tacoma, Washington.

FRANK FAULKNER has been appointed assistant production manager of the Walworth Manufacturing Co., South Boston, Mass. Mr. Faulkner has been with the company since October, 1919. He graduated from Dartmouth in the class of 1919, and is a son of President Faulkner of the Oliver Typewriter Co., Chicago.

J. F. GEARY, formerly assistant superintendent at the Chicago plant of the American Brake Shoe and Foundry Co., is now manager of manufacturing for the Federal Radiator Co. at Zanesville, Ohio.

J. F. BOYD, formerly with the Cyclops Steel Co., has been placed in charge of sales of Wetmore expanding reamers in the Chicago district, which includes Illinois, Missouri and northern Indiana. The Scully-Jones Co., Chicago, will continue handling Wetmore products as heretofore; Mr. Boyd's office is at 846 Marquette Building, Chicago.

FRANK E. CABLE, formerly treasurer of the Porter-Cable Machine Co., Syracuse, N. Y., has retired from active business on account of his health, and is now residing in Nantucket.

RALPH K. POWELL, formerly equipment engineer at the International Motors Corporation, has become a director and vice president of Hubbard & Harris, Inc., consulting engineers, Bridgeport, Conn. He will interest himself particularly in the machine and equipment designing department.

GUY E. MARION, former president of the Special Libraries Association, has completed his war work in New York City with the Community Motion Picture Bureau. He will now return to his own professional work of organizing special libraries for corporations, business houses, associations, and other enterprises requiring correct and up-to-date information within their fields. Mr. Marion still resides in Upper Montclair, N. J., but will soon resume his old address at 27 State St., Boston, Mass.

I. F. MACKAY, formerly secretary-treasurer of Willys Overland, Ltd., has been appointed general manager of the John Morrow Screw and Nut Co., Ltd., Ingersoll, Ont.

G. E. ANDERSON, formerly assistant Eastern sales manager of the Duff Manufacturing Co., Pittsburgh, has been promoted to the position of sales manager, and placed in charge of its new branch office located in the Railway Exchange Building, St. Louis, Mo.

WILLIAM J. MCCANN has recently been appointed service manager of the Chapman Valve Manufacturing Co., Indian Orchard, Mass.

Obituary

Joseph Kinne Sharpe, Jr.

JOSEPH KINNE SHARPE, JR., inventor and president of the Indiana Manufacturing Co., died at his home, 1314 North Delaware St., on Oct. 26, from the effects of an operation undergone about a year ago. Although Mr. Sharpe had appeared to be in excellent health since the operation, physicians agreed that his participation in athletics soon after the operation caused his death. He was 65 years old.

Mr. Sharpe was a native of Indianapolis, a graduate of private schools here and of Wabash College. He entered the leather tanning business established by his father in 1885, and assisted in the organization of the Indiana Manufacturing Co., which was formed to exploit one of his own inventions in 1891. In January of the same year he married Miss Alberta S. Johnson, daughter of Dr. W. P. Johnson. Mr. Sharpe became president of the company in 1907. The invention which caused the formation of the Indiana Manufacturing Co. was an appliance for threshing machines which was sold widely throughout the world's wheat belts.

ALEXANDER J. MCCONE, founder and president of the Fulton Engine Works at Los Angeles, Cal., died at St. Vincent's hospital in that city on Oct. 27 from apoplexy. Mr. McCone was born 61 years ago and had resided in Los Angeles for five years. He was one of the founders of the Harron, Rickard & McCone Co. of San Francisco, wholesale dealers in machinery. Mr. McCone once served as speaker of the lower house in the Nevada Legislature. His wife and four children survive him.

FRANK WILLIAMS, president of I. B. Williams & Sons, belt manufacturers, died at his home on Oct. 27 after an illness of two years.

Business Items

Articles of incorporation have been filed in Indiana by the Laporte Machine and Tool Co., a newly organized company that will engage in the manufacture of machine tools. The company's directors are T. W. Witters, Albert E. Hommann and Lawrence Johnson, all of Laporte.

The capital stock of the Wheeling Machine Products Co., Wheeling, Va., has been increased from $50,000 to $100,000. E. W. Krause is treasurer and general manager.

C. W. Hunt Co., Inc., announces the formation of the C. W. Hunt Engineering Corporation, with offices at 143 Liberty St., New York, for the purpose of handling all sales entailing engineering in connection with the Hunt products.

On the application of the Vonnegut Machinery Co. Charles O. Roemler, of Indianapolis, and Robert M. Fuestel, of Ft. Wayne, were appointed joint receivers for the Spacke Machine and Tool Co. by Judge Harry O. Chamberlin, in circuit court recently.

The Tacony Steel Co., 1417 Sansom St., Philadelphia, announces the appointment of D. J. CROWLEY as Michigan sales agent. Mr. Crowley's office will be in the Dime Bank Building, Detroit, Mich. The Tacony Steel Co. has also appointed D. B. CARSON as sales manager for the Cleveland district.

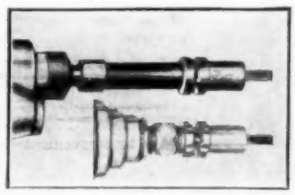
The Wyman & Gordon Co., Worcester, Mass., has reduced its capital stock from $4,400,000 to $3,850,000.

The W. C. Briddell Co., Inc., Baltimore, Md., has been incorporated with $100,000 capital stock to manufacture and deal in goods, wares and merchandise in any part of the world, including the purchase and sale of rails,

Condensed-Clipping Index of Equipment

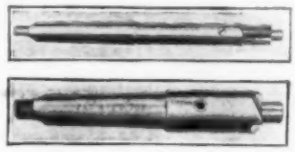
Patented Aug. 20, 1918

Attachments, Screwdriver, for "Thor" Portable Drill Motors
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.
"American Machinist," Oct. 14, 1920.



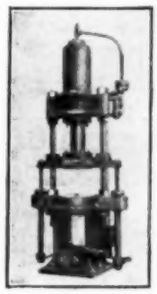
The devices are made in three styles to fit different types of portable motors. The No. 1 attachment for the Thor turbine air drill is shown at the bottom, it being capable of handling up to No. 12 wood screws, 1⅜ in. long. For use on electric drills the attachments are built in two styles, the short type, No. 3, and the No. 2 extension type shown at the top. The latter will handle any size of wood screws, ⅞ in. or longer up to No. 14, 2 in. long. The No. 3 attachment can be used on the No. 00 Thor electric drill only when the latter has been equipped with a special spindle and gear case.

Counterbores and Spot-Facers, Interchangeable, "Duplex"
Dayton Machine Products Co., Dayton, Ohio
"American Machinist," Oct. 14, 1920.



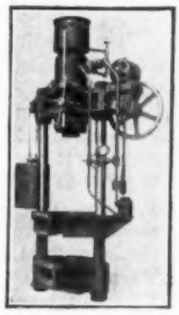
This type of counterbore consists of a holder, cutter, pilot and locking screw. The holder and pilot are made of low-carbon steel case-hardened. The cutter is of high-speed steel and has two cutting faces, both permitting of resharpening. The tool can be furnished with cutters from ⅝ to 3 in. in diameter. Morse taper shanks Nos. 1 to 6 are standard, although straight-shank holders can be furnished. Pilots of all sizes can be furnished. The tool can be disassembled by the removing of one screw, and the interchangeability of the cutters to different holders is one of its chief advantages.

Press, Hydraulic, Bushing, 20-Ton
Southwark Foundry and Machine Co., Philadelphia, Pa.
"American Machinist," Oct. 14, 1920.



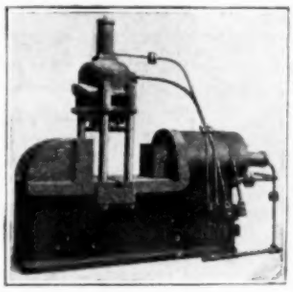
This machine is intended for forcing broaches through castings and forgings. The clearance between columns is 20 in. The distance between the moving and the bottom tables is adjustable by means of long threads on the tension bolts from 24 in. as a maximum to 16 in. as a minimum. Two auxiliary pressure cylinders provide for the quick return of the table and ram. A dashpot placed in the top of the main cylinder eliminates shock at the end of the return stroke. Number of strokes, 15 to 20 per minute. Pressure, 1,500 lb. per square inch. Floor space, 3 x 2 ft. Height, 9 ft.

Press, Hydraulic, Bushing, 200-Ton
Southwark Foundry and Machine Co., Philadelphia, Pa.
"American Machinist," Oct. 14, 1920.



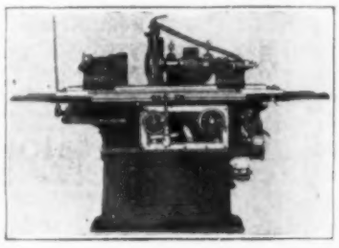
The ram of this press is 12 in. in diameter. A pressure of 200 tons is therefore obtainable when a hydraulic pressure of 3,500 lb. per square inch is used. The motor is geared to a pump having two ¾-in. plungers operating with a 3-in. stroke in a forged steel body. The top of the intermediate platen is 27 in. above the bottom one. The maximum clearance between the ram and intermediate platen is 45 in.; the distance between the two 6-in. diameter columns is 32⅞ in. The height is 13 ft., 2 ft. being below the floor. The two platens are slotted and bored to accommodate locomotive piston rods.

Press, Hydraulic, Upsetting, 200-Ton
Southwark Foundry and Machine Co., Philadelphia, Pa.
"American Machinist," Oct. 14, 1920.



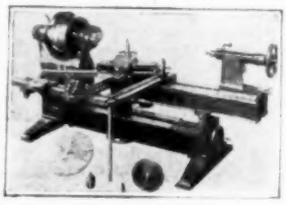
This press is suitable for upsetting the flanges on automobile crankshafts. The horizontal ram is capable of exerting a pressure of 200 tons and it has a stroke of 12 in. The vertical ram has a 9-in. stroke, and can exert a pressure of 110 tons. The maximum distance between the face of the horizontal ram and the horn is 33 in., and the vertical clear opening with the vertical ram raised is 22½ in. The machine is intended to operate with a hydraulic pressure of 1,500 lb. per square inch, the pressure being supplied from an accumulator system. The floor space required is 12 x 3 ft., and the overall height is 10 ft. The total weight is 30,000 lb.

Grinding Machine, Cylindrical, Plain
Webster & Perks Tool Co., Springfield, Ohio
"American Machinist," Oct. 21, 1920.



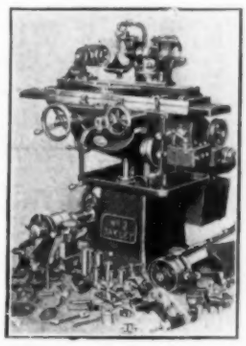
Specifications: Capacity; normal, 6 x 30 in. maximum, 10¼ x 32 in. Swivel table graduations up to 3½ in. per foot. Headstock spindle; diameter, 2¼ in.; hole, No. 2, Morse taper; length of bearings, front, 3½ in.; tapered, rear, 3 in. Wheel spinde, 1¾ x 22¾ in. Wheel: face, 1½ to 2 in.; diameter, up to 14 in. Length of table ways, 50 in. Water tank capacity, 25 gal. Horsepower, 5. Wheel speeds, 1,680 and 1,920 r.p.m. Work speeds, 4, from 48 to 192 r.p.m.. Table speeds, 8, from 6 to 94 in. per minute. Reduction by automatic crossfeed, minimum, 0.00025 in.; maximum, 0.005. Floor space: 43 x 116 in.; with unit countershaft, 66 x 116 in. Weight: net, 3,000 lb. with overhead countershaft, 5,050 lb. with unit countershaft; shipping, 4,300 and 5,650 lb.

Lathe, Spinning, Extension, and Attachments
P. Pryibil Machine Co., 512-24 West 41st St., New York City.
"American Machinist," Oct. 21, 1920.



The machine is of the extension-bed type, its members having box sections. The longitudinal feed is 16 in. and the crossfeed 9 in., a ⅝ x 1¼-in. tool being used. The machine is equipped with 20-in. and 12-in. faceplates. "Compound-lever spinning tools" are especially adapted for use on the machine when spinning heavy sheets. Specifications: Swing, 27 and 60 in. Height of spindle, 41 in. Front bearing, 2½ x 9½ in. Horsepower required, 5 to 12. Floor space; base, 32 x 84 in.; maximum overall, 52 x 134 in. Weight; net, 4,500 lb.; with countershaft, 5,000 lb.; crated, 5,150 lb.; boxed for export, 5,600. Export box, 75 cu.ft.

Grinding Machine, Toolroom, Universal, No. 3
Oakley Machine Tool Co., Cincinnati, Ohio
"American Machinist," Oct. 21, 1920.



Features of this machine are the mounting of the cone pulleys and the rack and pinion table drive. Specifications: Table surface, 5¼ x 33¾ in. Taper adjustment, 2 in. per foot. Distance, center of spindle to table, minimum, 0 in.; maximum, 10½ in. Longitudinal movement, 17 in. Vertical movement, 10½ in. Cross movement, 9 in. Maximum distance between centers, 20 in. Workhead taper hole, No. 12 B & S. Swing over table, 10 in. Wheel speeds, 3,683 and 5,950 r.p.m. Countershaft pulleys, 6 in. in diameter, 2¼ in. belt, 850 r.p.m. Floor space, 68 x 53 in.

Clip, paste on 3 x 5-in. cards and file as desired

railway and truck equipment, iron, steel and metal products.

The Republic Boiler and Radiator Co., Baltimore, Md., has been incorporated with $1,000,000 capital stock to manufacture, deal in and operate steam and hot-water boilers and apparatus.

Announcement has been made of the formation of what is to be known as the Ryan-Kellogg Conveyor Corporation, newly organized company with home offices in Elkhart, Ind. The company recently filed articles of incorporation with the secretary of state of Indiana, showing a capitalization of $200,000. It plans to manufacture conveying machinery of all descriptions.

Articles of incorporation were recently filed by the Specialty Gage and Tool Co., Elkhart, Ind., an organization formed in Indianapolis for the purpose of jobbing and retailing gages and machine tools. The company has a capital stock of $100,000, half of which is preferred stock.

The Detroit branch office of the Wetmore Reamer Co., of Milwaukee, has formed a new company to handle the sales of Wetmore expanding reamers in the State of Michigan, exclusive of the northern peninsula. James J. Ward has resigned as assistant sales manager of the Wetmore company to become one of the three members of the new firm known as the Wayman-Taylor-Ward Co. Messrs. Taylor and Wayman have previously handled this work. Mr. Ward's experience, resulting from two years' work spent in various parts of the country with the sales force, will be of considerable value in the new organization. The location of the offices have been changed to 403 Real Estate Exchange Building, Detroit.

Trade Catalogs

Ajax Metal Products. The Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala. Catalog, pp. 38, 8 x 10 in. This catalog is mainly devoted to a complete list of Ajax products, with a detailed account of their manifold uses in the various industries. It is printed in Spanish and English and a copy will be sent upon request.

Foundries. Whiting Corporation, Harvey, Ill. Catalog No. 154, pp. 49, 8½ x 10¾ in., giving illustrations and descriptive matter of the company's foundry layouts and equipment.

Welding and Cutting Equipment. The Bastian-Blessing Co., West Austin and La Salle St., Chicago, Ill. Catalog No. 20, pp. 36, 7½ x 11¼ in. It illustrates and describes Rego welding and cutting apparatus. Prices are also given.

Winchester Opportunities for Apprentices. Winchester Repeating Arms Co., New Haven, Conn. A well-bound 5 x 8-in. catalog giving a brief outline of the apprenticeship system for young men which is in operation at this plant. It gives a survey of Winchester manufacturing methods and ideals, leading up to a descriptive discourse on the apprenticeship course. Eligibility, requirements, supervision and instruction, term of service and compensation form some of the interesting chapters.

Winchester Opportunities for College Men. Winchester Repeating Arms Co., New Haven, Conn. This company has faith in the serious-minded young college man who is ambitious to become a leader, instead of a follower. A course of training is offered such college graduates as may wish to build up a future in the "W" organization. A full outline of this course, the requirements necessary to enter, the subjects covered and the possibilities for advancement after completion of the course, are given.

Motor Control Apparatus. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Booklet, pp. 40, 8½ x 11 in. This booklet takes up in a general way the control of motor-driven pumps and compressors on water and compressed air systems, in mines, on board ships, for hydraulic elevators, etc.

"Hopewell"—America's Greatest Industrial Opportunity. A small but interesting pamphlet, published by the Du Pont Chemical Co., Wilmington, Delaware. It tells a vivid story by word and picture of the change of Hopewell from a munition plant into a location for peace-time industries. The story tells of Hopewell's wharves, trackage, fire department, commissary, dwellings, hotels, clubs, recreation centers and the manufacturers already located there. The book also discusses some present-day industrial problems in an able and thorough manner.

Bore Grinder. Van Norman Machine Tool Co., Springfield, Mass. Four-page circular describing the No. 9. Van Norman machine, which is quoted as "a new and improved full ball-bearing machine for grinding straight or taper holes."

H. B. Electrical Equipment. Hobart Brothers Co., Troy, Ohio. Bulletin No. 66 covering ball-bearing motors, lighting and charging sets, belted chargers, and battery charging outfits.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An import and export agent in Jugo-Slavia desires to establish commercial relations with firms handling agricultural implements, railroad equipment, industrial machinery, electric motors and accessories, automobiles and mining machinery. Correspondence may be in English. No. 33,838.

A firm in Finland desires the agency for machinery, chemicals and oil, quotations to be c.i.f. Finnish port. References. No. 33,918.

A mercantile firm in Brazil desires an agency for the sale of automobiles and machinery. Quotations should be given c.i.f. Brazilian port and f.o.b. port of the United States. Correspondence may be in English. References. No. 33,794.

The agency for Switzerland is desired by a firm in that country for turners' lathes; boring, shaping, planing, milling, grinding, and wood-working machines; tool steel; electric motors up to 100 horsepower; emery wheels and other technical products. All articles to be first quality only. References. No. 33,913.

American manufacturers of railway-shop machinery, cranes, and foundry equipment are invited to submit catalogs to the manager of shops of an Argentine railway. No. 33,931.

A commercial agent in Serbia proposes to organize a trade bureau for the Balkans and to later open branches in Zagreb, Sofia, Bucharest, and Piræus, and maintain industrial exhibits and a warehouse for the promotion of the sale of American products, particularly agricultural implements, railroad equipment, industrial machinery, automobiles, metal household utensils, electric motors and accessories. Reference. No. 33,965.

A commission agent in Australia desires to represent manufacturers and exporters of machinery of all sorts, especially grinding machinery and machines for paint and soap manufacturing; and raw and semi-raw materials of all kinds for further manufacture within his country. Reference. No. 33,959.

The representative of a trading corporation in Chile is in the United States and desires to secure an agency for the sale of machinery, hardware, and leather and tanning material. Reference. No. 33,973.

New Publications

Annual Report of the Smithsonian Institution—1918. Six hundred twelve 5¾ x 9-in. pages. Fifty-four plates. Bound in dark-green cloth boards. Issued by the Superintendent of Documents, Government Printing Office, Washington, D. C.

The first 115 pages of this volume are taken up with reports of the secretary of the Smithsonian Institution, the United States National Museum, the Bureau of American Ethnology, the National Zoological Park, the Library, the Publications and the Proceedings of the Board of Regents of the Smithsonian Institution. Following these are excellent papers, some of which follow: "The Discovery of Helium and What Came of It," by C. G. Abbott; "An Account of the Rise of Navigation," by R. H. Curtiss; "Wind Power," by James Carlill; "A Tribute to Samuel Pierpont Langley—Pioneer in Practical Aviation," by Henry Leeffmann; "Twentieth-Century Physics," by R. A. Millikan; "High Pressure," by Dr. P. W. Bridgman; "Radioactive Lead," by Theodore W. Richards; "Mineral Supplies," by Eleanora F. Bliss; "History in Tools," by W. M. F. Petrie.

Handbook of Petroleum, Asphalt and Natural Gas. By Roy Cross. Four hundred ninety six 4¾ x 7¼-in. pages, many tables and illustrations. Bound in flexible black covers. Published by the Kansas City Testing Laboratory, 1013 Grand Ave., Kansas City, Mo.

The author says in his preface that this book is published to set forth in concise form for the petroleum producer, seller, refiner and technologist, scientific information and statistics on the production, properties, handling, refining and methods of valuation of petroleum and related products. Much of the matter is the result of original research in the Kansas City Testing Laboratory. A general outline of the main topical divisions include economics, geology, production and refining statistics, storage, measurement, gaging, transportation, chemical and physical properties and distillation of crude oil, gasoline, naphtha, benzines, mineral spirits, kerosene, illuminating oils, absorption oils, lubricating oils, greases, waxes, fuel oils and fuels, asphalt and road oil, cracking and engineering, oil shales and shale oil products, natural gas, methods of analysis, tables, list of patents, bibliography and index.

Catalogs Wanted

Chung Mei Trading Corporation, 2 Hong Kong Road, Shanghai, China, would like catalogs of all kinds of metal and wood-working machinery. As far as possible prices should accompany the catalogs.

Forthcoming Meetings

The National Machine Tool Builders' Association will hold its 19th annual Fall convention at the Hotel Astor, New York City, on Thursday and Friday, Nov. 11 and 12, 1920. C. Wood Walter, care of the association's offices at Worcester, Mass., is secretary.

The National Founders Association will hold its twenty-fourth annual convention at the Hotel Astor on Nov. 17 and 18, 1920. J. M. Taylor, care of the Association, 90 West St., New York, is secretary.

The Federated American Engineering Societies will hold its first meeting at the Hotel New Willard, Washington, D. C., on Nov. 18 to 20 inclusive.

The 1920 annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West 39th Street, New York City, from Dec. 7 to Dec. 10.

The Society of Automotive Engineers will hold its annual meeting on Jan. 11 to 13 inclusive at New York.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Threading Tool, Spring

Armstrong Brothers Tool Co., 317-57 N. Francisco Ave., Chicago, Ill.

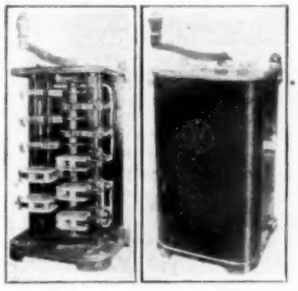
"American Machinist," Oct. 21, 1920.

The tool combines strength and convenience of adjustment and operation with the resiliency which is usually considered to be helpful in obtaining a smooth thread or finishing cut, especially on alloy steels of a tough nature. Means are provided for quickly obtaining rigidity, so that the tool can be used for roughing or ordinary turning. The cutting tool can be swung to either side of its center position. Tools holding stock $\frac{5}{16}$, $\frac{1}{2}$, $\frac{5}{8}$, or $\frac{3}{4}$ in. square can be furnished. The holder sizes range from $\frac{3}{4}$ x $\frac{7}{8}$ x $5\frac{1}{2}$ in. to $\frac{3}{4}$ x $1\frac{3}{8}$ x $8\frac{1}{2}$ in., and the weights from $\frac{1}{2}$ to $3\frac{1}{4}$ lb.

Controller, Contactor, Type "S"

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

"American Machinist," Oct. 21, 1920.

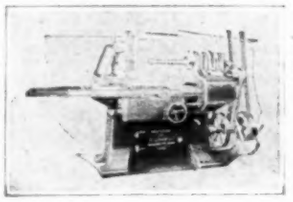


This controller is intended for starting and regulating the speed of shunt-series, and compound-wound d.c. motors; it will operate in any position. In operation it adjusts the resistance in series and parallel with the motor armature, and employs the same principal as the magnetic contactor type controller, except that the contactors are operated by cams mounted on the controller shaft. The line contactors are protected by magnetic blow-outs. This type of controller can be supplied either with or without dynamic braking and is applicable for use with motors or cranes, hoists, crushers, bridges, roll and transfer tables and practically all places employing this system of control.

Grinding Machine, Internal, "Micro"

B. L. Schmidt Co., Davenport, Iowa

"American Machinist," Oct. 21, 1920.

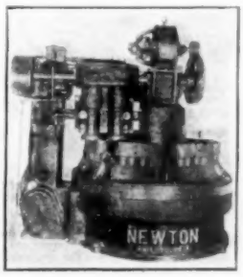


Features of this machine are the provision made for wet grinding and the semi-automatic operation. Specifications: capacity; grinds holes $2\frac{1}{2}$ to 10 in. in diameter up to 13 in. long (longer spindles furnished, if desired). Wheels: diameter, $2\frac{1}{2}$ to 6 in.; face, $\frac{3}{4}$ in.; hole, $1\frac{1}{4}$ in. Wheel-spindle speeds, 5,500 and 3,652 r.p.m. Main bearing, 7 x 16 in. Planetary speeds, 48 and 25 r.p.m. Table; to center of spindle, 13 in.; size, 19 x 48 in.; speeds, 11, $6\frac{1}{2}$, $5\frac{3}{4}$, $4\frac{1}{2}$, $3\frac{5}{8}$ and $2\frac{1}{2}$ in. per minute. Cross-slide; travel, 14 in.; adjustable to 34 in. Speed of drive shaft, 265 r.p.m. Floor space; over all, 110 x 42 in.; base, 54 x 26 in. Height, 39 in. Weight, 4,000 lb.

Milling Machine, Continuous, Ring-Table, "Second Model"

Newton Machine Tool Works, Inc., 23d and Vine St., Philadelphia, Pa.

"American Machinist," Oct. 28, 1920.

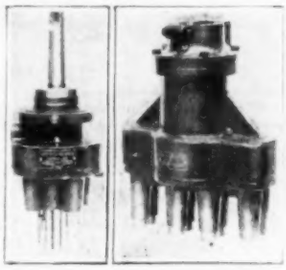


The column in the center is tapered. The table is fitted to the column and is provided with an annular bearing close to its periphery. It is 84 in. in diameter, and the thickness from the annular bearing to the top is 12 in. The least diameter of the taper bearing between the column and the table is 36 in. The table is provided with a finished hub 42 in. in diameter to assist in locating jigs. It is rotated by an 81-in. herringbone gear. The distance from the centers of the roughing cutters to the center of the finishing cutter is 42 in., so that the roughing operation can be completed on a casting before the finishing operation commences. Only a very light finishing cut is taken. The spindles are independently adjustable for height.

Drill Heads, Fixed Center, Multiple-Spindle

United States Drill Head Co., Cincinnati, Ohio.

"American Machinist," Oct. 21, 1920.

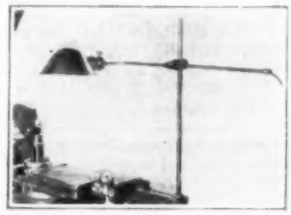


The main spindle of each of these especially designed heads is fitted with a bronze bearing, and both the main and drill spindles are provided with ball thrust bearings. All gears, spindles and studs are hardened steel, the gears running in grease. There are two methods of attaching the heads to the drilling machine. The lighter heads are driven by a standard taper shank, as shown at the left. Heavy heads are driven by the method shown at the right, the head clamping to the quill and being driven by a key inserted in the drift slot of the spindle. The first method requires the use of a bar to prevent the head from turning with the spindles.

Lighting Fixture "Anyangl"

Miller Saw-Trimmer Co., Pittsburgh, Pa.

"American Machinist," Oct. 21, 1920.



This device is intended especially for attaching to a machine, so that light may be concentrated upon the work. The lamp is provided with a reflector and a cage for preventing breakage. It can be swung in a complete circle either horizontally or vertically or adjusted for height, it being necessary to loosen only one thumbscrew for the purpose of making the adjustment. It is claimed that, when clamped, the position of the light is not disturbed by vibration. The fixture can be furnished with a base for bench use, and different lengths of upright and crossarm can be supplied.

Clamp, Drill, "Canton"

Poyser-Bucher Co., Canton, Ohio

"American Machinist," Oct. 21, 1920.

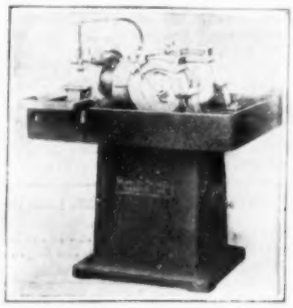
This clamp was designed for use in conjunction with portable drilling machines for drilling the flanges and webs of I-beams, etc. The method of attaching the device is shown in the illustration.

Grinding Machine Wet Tool Oilstone

Mummert-Dixon Co., Hanover, Pa.

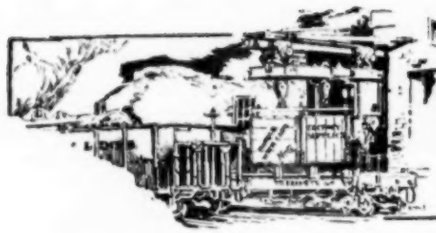
(The address was erroneously given in the Oct. 28 issue.)

"American Machinist," Sept. 30, 1920



This machine is intended for general tool grinding in both toolrooms and machine shops, and is provided with three wheels of different grades. It is thus possible to rough and finish a tool on the same machine. The machine can be driven either by motor or by belt, a countershaft being furnished in the latter case. Specifications—Size of wheels: coarse, 16 x 2 in.; medium and fine, 10 x $2\frac{1}{2}$ in. Speed: coarse wheel and pulley, 1,350 r.p.m.; medium and fine wheels, 675 r.p.m.; countershaft, 450 r.p.m. Driving pulley, 6 x $4\frac{1}{2}$ in. Countershaft: length, 24 in.; drop, 12 in. Motor, 3 hp., 1,800 r.p.m. Floor space, 33 x 41 in. Net weight, 1,075 lb.; with countershaft, 1,285 lb.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$46.50	$30.35
Northern Basic	51.30	27.55
Southern Ohio No. 2	48.50	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	57.12	32.40
Southern No. 2 (Silicon 2.25 to 2.75)	52.10	35.20
BIRMINGHAM		
No. 2 Foundry	42.00@45.00	29.25
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	51.25	29.00-30.00
Virginia No. 2	50.00*	33.10
Basic	51.00†	26.75
Grey Forge	48.00*	26.75
CHICAGO		
No. 2 Foundry local	47.00	26.75
No. 2 Foundry, Southern	48.67	28.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	49.56	28.15
Basic	48.96	27.15
Bessemer	51.96	29.35

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.30	$4.58	$3.47	$3.44	$3.37	$4.08	$3.47
Soft steel bars	4.75	4.73	3.37	3.84	3.27	3.98	3.37
Soft steel bar shapes	4.75	4.73	3.37	3.84	3.27	3.98	3.37
Soft steel bands	6.43	6.43	4.07	6.25	...	...	...
Plates, ¼ to 1 in. thick	4.50	4.78	3.67	3.64	3.57	4.28	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.77
Warehouse, New York	4.75	3.37
Warehouse, Cleveland	3.52	3.27
Warehouse, Chicago	4.12	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55-7.00	7.00@8.00	4.57	6.75	7.13
No. 12	3.60-7.05	7.05@8.05	4.62	6.80	7.18
No. 14	3.65-7.10	7.10@8.10	4.67	7.35	7.23
No. 16	3.75-7.20	7.20@8.20	4.77	7.45	7.33
Black					
Nos. 18 and 20	4.20-6.20	8.40@9.80	5.30	8.30	7.90
Nos. 22 and 24	4.25-6.25	8.45@9.85	5.35	8.35	7.95
No. 26	4.30-6.30	8.50@9.90	5.40	8.40	8.00
No. 28	4.35-6.35	8.60@10.00	5.50	8.50	8.10
Galvanized					
No. 10	4.70-8.00	8.90@11.00	5.75	8.50	8.25
No. 12	4.80-8.10	9.00@11.00	5.85	8.60	8.30
No. 14	4.80-8.10	9.00@11.10	5.85	8.60	8.45
Nos. 18 and 20	5.10-8.40	9.25@11.40	6.15	8.90	8.75
Nos. 22 and 24	5.25-8.55	9.40@11.55	6.30	9.05	9.15
No. 26	5.40-8.70	9.55@11.70	6.45	9.20	9.30
No. 28	5.70-9.00	9.85@12.00	6.75	9.50	9.60

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled.

Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.36	$5.90	$5.50
Flats, square and hexagons, per 100 lb. base	6.86	6.40	6.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound F.O.B. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots			45
Malleable nickel sheet bars			47
Hot rolled rods, Grades "A" and "C" (base)			60
Cold drawn rods, grades "A" and "C" (base)			72
Copper nickel ingots			42
Hot rolled copper nickel rods (base)			52
Manganese nickel hot rolled (base) rods "D"—low manganese			64
Manganese nickel hot rolled (base) rods "D"—high manganese			67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: 5/32, 8½c. per lb.; ¼, 8c.; 5/16 to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.15
Spring steel (light)	10.00	11.00	12.25
Coppered bessemer rods	9.00	8.00	6.85
Hoop steel	6.68	6.50	5.43
Cold-rolled strip steel	12.50	8.25	11.00
Floor plates	6.75	6.00	6.88

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD					
Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	54-57½%	41½-44%	⅜	15½-25½%	+1½-11½%
			½	19½-29½%	1½-11½%
			¼ to 1¼	24½-34½%	8-18½%
LAP WELD					
2	47-50½%	34½-38%	1¼	...	...
2½ to 6	50-53½%	37½-41%	1½	...	...
7 to 12	47-50½%	33½-37%	2	20½-28½%	6½-14½%
13 to 14	37½-41%	...	2½ to 6	22½-30½%	9½-17½%
15	35-38½%	...	7 to 12	19½-27½%	6½-14½%
			2½ to 4	22½-30½%	9½-17½%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
¼ to 1½	52-55½%	39½-43%	¼ to 1½	24½-34½%	9½-19½%
2 to 3	53-56½%	40½-44%			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45-48½%	33½-37%	1¼	...	...
2½ to 4	48-51½%	36½-40%	1½	...	...
4½ to 6	47-50½%	35½-39%	2	21½-29½%	8½-16½%
7 to 8	43-46½%	29½-33%	2½ to 4	23½-31½%	11½-19½%
9 to 12	38-41½%	24½-28%	4½ to 6	22½-30½%	10½-18½%
			7 to 8	14½-22½%	2½-10½%
			9 to 12	9½-17½%	5½-+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	38%	22%	39%	30%	54%-40%	40½@30%
2½ to 6 in. steel lap welded	33%	18%	41%	26%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	14.75@15.00	18.50	22.50
Tin in 5-ton lots	39.00	44.50	56.50
Lead	7.00@7.25	8.50	6.25
Zinc	7.00	8.50	7.60
ST. LOUIS			
Lead	6.80@7.05	8.00	6.00
Zinc	6.60	7.70@8.05	7.15

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

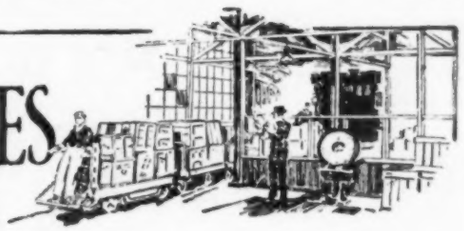
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	24.50	29.50	33.50	29.00	35.50	36.00	36.50
Copper wire (carload lots)	31.25	31.25	30.75	24.00	30.50	29.00	26.00
Brass sheets	28.50	28.50	32.00	25.00	33.00	27.00	28.00
Brass pipe	28.00	33.00	36.00	30.00	39.00	34.00	37.00
Solder (half and half) (case lots)	35.00	35.00	45.00	29.00	41.00	38.00	38.50

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	25.00	24.00
New York	27.00	28.00@29.75
Cleveland	24.00	29.00
Chicago	30.00	27.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 12.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.30	12.50	14.70	13.00
New York	14.00	11.50	14.50	12.50
Chicago	14.50	16.50	14.95	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.25	9.50
Chicago	7.50	9.75
Cleveland	8.50	9.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	12.50	17.00	12.00	13.50
Copper, heavy, and wire	12.00	16.00	11.75	12.50
Copper, light, and bottoms	10.00	14.00	10.00	11.00
Lead, heavy	5.50	4.75	5.50	6.00
Lead, tea	4.50	3.75	3.75	5.00
Brass, heavy	7.00	10.50	8.00	12.50
Brass, light	5.50	7.50	5.00	6.50
No. 1 yellow brass turnings	7.00	10.00	6.00	6.75
Zinc	4.50	5.00	3.75	5.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	$33.00	$30.00	$33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	32.00
Chicago	29.00	31.00
Cleveland	27.00	35.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	80.00	90.00	49.00	70.00	45.00	60.00
Commercial	40.00	50.00	19.50	16.50	11.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from $16 to $20.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$1.25	$1.50	List net	$2.25	+1.15	1.85
Hot pressed hexagon	+1.25	1.50	List net	2.25	+1.15	1.85
Cold punched hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.30
Cold punched square	+ 1.25	1.50	List net	2.25	+1.15	1.30

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50-10%
Chicago	40%	50%
Cleveland	50%	60-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+10%	25%	20%
Larger and longer up to 1¼ in. by 30 in.	Net list	25%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... list Cleveland..... $2.50 Chicago..... $1.90

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+20%	25%	10%
Larger and longer up to 1 in. by 30 in.	+20%	20%	5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	10%
Chicago	net	20%	net	20%
New York	30%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	20%	40%	30%
Tinned	20%	40%	30%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.73 Pittsburgh..... $4.5

Structural, same sizes:
New York..... $7.10 Chicago..... $5.83 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	29.00	33.00	35.00
Brass	28.00	30.00	34.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add 15-20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $11.50 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
White	15.00@17.00	13.00	16.00	11.00 to 14.00
Colored mixed	9.00@14.00	9.00-12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00-2.10	$2.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	3.00	2.50
Chicago	2.00	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40-3.90	$3.90	$3.65
Philadelphia	3.65	3.65	3.87
Chicago	4.10	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	November 7	November 1	October 25
Prompt furnace	$16.00@$16.50	$16.00@$16.50	$16.00@$16.50
Prompt foundry	17.00@18.00	17.00@18.50	17.00@18.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

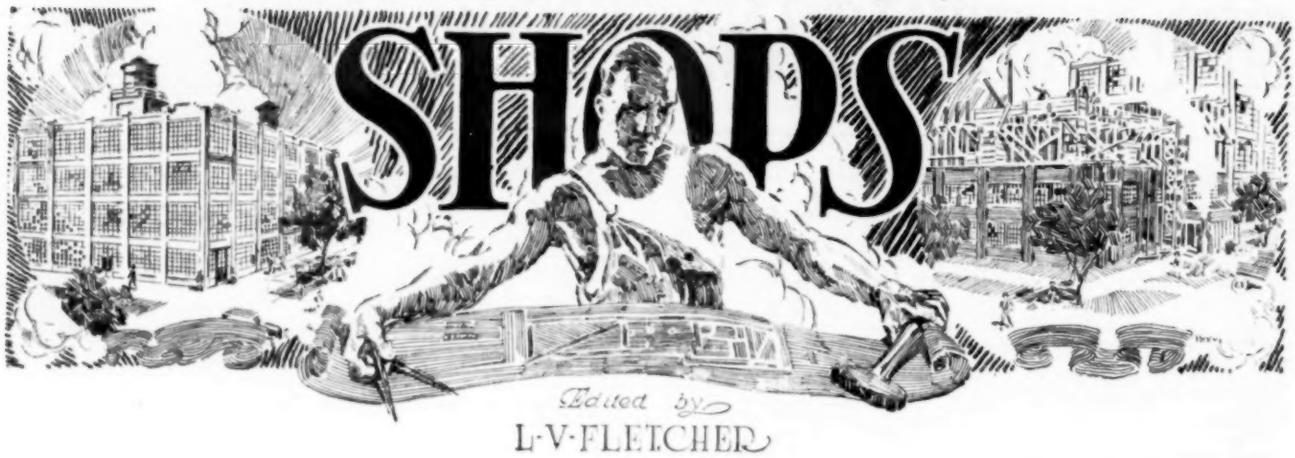
	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$1.07	$2.15	$1.25	$2.50	$1.20	$2.37
5-gal cans	1.22	2.30	1.50	2.75	1.45	2.57
1-gal cans (6 to case)	1.32	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	— Red —				— White —	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 1% discount. 2000 lb. lots less 10-20½% discount.

NEW and ENLARGED



Edited by
L·V·FLETCHER

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., Boston—The Boston Elevated Ry. Co., 108 Massachusetts Ave., E. Mahler, Purch. Agt.—one 24 in. x 10 ft. Q. C. gear lathe with 3 step cone double back gears with taper attachment, similar to Cincinnati heavy duty No. 106 and taper attachment No. 72.

N. J., Kearney—The Federal Ship Building Co.—one 20 in. drill press with a No. 3 Morse taper and spindles.

N. Y., Buffalo—The Day Mchy. Co., 66 Exchange St.—one 2,000 lb. board drop hammer, one multiple spindle drill with twelve 1 in. spindles, one 4 in. centering machine, one 2 in. Acme bolt header, one No. 12 Ajax bulldozer, one 60 in. vertical boring mill, one 36 in. vertical boring mill.

N. Y., New York (Borough of Manhattan)—The Errington Mechanical Laboratory, 11 John St.—one 24 in. B. G. drill press, back geared, one plain milling machine and one surface grinder.

N. Y., New York (Borough of Manhattan)—The International Nickel Co., 43 Exchange Pl.—rolling mill equipment for its proposed plant at Huntington, W. Va.

N. Y., New York (Borough of Manhattan)—The Longacre Supply Co., 441 West 40th St.—one 1 to 6 in. pipe cutting machine.

N. Y., New York—(Borough of Manhattan)—A. Stroud, 327 Bway.—One 32 in. Gleason gear generator, (used).

Pa., Lewistown—The Keystone Motor Co., Main and 3d Sts.—garage equipment.

Pa., Burnham—The Standard Steel Wks. Co.—automatic screw cutting machines of several styles (new or used.)

Pa., Philadelphia—The Purchasing Dept., Navy Yard—1 pattern making lathe.

Pa., Pittsburgh—The United States Chain & Forging Co., Union Arcade—an open side surface grinder, similar to Emery No. 130.

Pa., Williamsport—The McCormick Motor Co.—general machine tools.

La., New Orleans—J. de Tarnowsky, Archt. and Structural Engr., 602 Canal Book Annex—one hand operated crane 22 ft. 6 in. span, to have 10 ton capacity.

La., New Orleans—O. H. Van Horn Co., 518 Camp St.—one 6 ft. vertical boring mill, motor drive, a.c., 220 volt.

Ill., Elgin—The Illinois Watch Co.—sheet metal straightening machine.

Ind., Lebannon — The Indestructible Wheel Co.—turret lathes, drill presses and riveting machines.

Mich., Detroit—J. Brodie, 13 Jones St., manufacturer of furnaces and tinning—sheet metal working equipment.

Mich., Detroit—The Continental Trailer Co., 835 Superior St.—miscellaneous machine tools.

Mich., Detroit—The Dept. of Purchases and Supplies, Municipal Court Bldg., G. J. Finn, Purch. Agt.—two pneumatically operated hammer tools, two sets pneumatic tampers, two dozen ¾ in. x 3 in. face tamping bars and twelve electric welding shields (new.)

Mich., Detroit—The Halab Stamping Co., 744 West Grand Blvd.—equipment for making metal stampings.

Mich., Detroit—The Street Ry. Comn., 410 City Hall, G. J. Finn, Purch. Agt.—two pneumatic drills.

O., Columbus—W. E. Lamneck Co., West 5th Ave., manufacturers of furnaces and ventilation plants, A. P. Lamneck, Secy.-Treas.—metal working machinery.

O., New Philadelphia — The Ladel Mfg. Co.—electrically driven crane.

O., Youngstown—The Reserve Iron & Steel Co.—machines, tools, etc., for $1,000,000 plant.

Wis., Fort Atkinson—The Bull Milking Machine Co., North Main St., L. Bull, Purch. Agt.—one 18 in. engine lathe, 7 ft. bed, one 18 in. shaper and one universal grinder.

Wis., Milwaukee—Englert Bros., 314 6th St., sheet metal workers, A. Englert, Purch. Agt.—punch and drill presses.

Wis., Milwaukee—Jochem-Poehlmann Co., 743 Astor St., W. Poehlmann, Purch. Agt.—garage repair machinery.

Wis., Milwaukee—The Master Seeder Co., 1205 20th St., manufacturers of drill seeders, H. Zimmermann, Purch. Agt.—shaper, lathes and drill presses.

Wis., Milwaukee—A. Wambold, 1382 Teutonia Ave. (machinist)—one 20 in. drill press and one engine lathe.

Tex., San Artonio—The Southern Steel Co., 4500 South Presa St., quote f.o.b. San Antonio and name earliest date of delivery on the following:

One gate shear, sufficient capacity to shear at one stroke the edge of ¾ in. plate 8 ft. long.

One multiple punch, capacity to punch at one stroke a row of ¾ in. diameter holes 1½ in. apart along the entire edge of a plate ¾ in. thick and 8 ft. long.

One bending roll, capacity No. 10 plate and 8 ft. between housing.

One flanging machine or brake of sufficient capacity to turn down at one stroke an angle 2 in. wide on the edge of a No. 10 plate 8 ft. long.

One straightening roll, capacity ¾ in. plate, 3 ft. 6 in. wide.

One plate planer suitable for planing true and straight the edges of ¾ in. thick plates 3 ft. wide x 8 ft. long.

Please quote on these machines motor driven and also belt driven, and with each quotation send the name of the maker, number of the machine, complete specifications, its exact condition, and also a photograph.

N. B., St. John—T. McAvity & Sons, Ltd.—a few No. 6 turret screw machines.

Ont., London—T. Terry, 150 Maple St.—tools and equipment for general machine and auto repair shop.

Ont., Toronto—The Crouse Hinds Co. of Canada and Harvey-Hubbell Co., 7 Lobatt Ave., and the Hubbell-Mack Machine Screw Co.—machinery for the manufacture of electric light fixtures, switches, electric panels, machine screws, bolts, etc.

Cuba, Havana—The National Steel Co., 441 Lonja del Comercio—lathes, planers and shapers.

Machinery Wanted

N. Y., Lewiston—The River Side Pulp & Paper Co., W. Burke, Purch. Agt.—paper mill machinery.

N. Y., Lincoln Park—T. W. Kneeland Co., manufacturers of paper making machinery, T. W. Kneeland, Purch. Agt.—paper mill machinery.

D. C., Washington—The Bureau of Supplies & Accounts, Machinery Div., Navy Dept.—one woodworking lathe, motor driven, one motor driven band saw and one motor driven emery grinder, for the S. S. Minas Georaes.

Ill., Chicago—The New Way Laundry, c/o Ronneberg, Pierce & Hauber, Archts., 10 South La Salle St.—laundry machinery.

Ind., Anderson—The Lavelle Fdry Co.—general foundry equipment and possible pattern shop machinery.

Mich., Detroit—The Leverenz Lumber & Building Co., 615 Beaufait Ave.—woodworking equipment to include machines for making sash and finish.

Mich., Detroit—The Lincoln Paint & Color Co.—electrically driven machinery for the manufacture of paints for its proposed paint factory at Dallas, Tex.

Mich., Detroit—Orling Bros., Heidelberg and Elmwood Aves.—refrigerating machinery, meat cutters, etc.

Wis., Beloit—Ferguson Bros., 319 St. Paul Ave., manufacturers of truck bodies, etc.—woodworking machinery.

Wis., Racine—The Grant Furniture Co., 502 6th St., S. Grant, Purch. Agt.—woodworking machinery.

Wis., Rice Lake—The New Idea Potato Mchy. Co.—machinery for its proposed plant.

Cal., Anaheim — The Anaheim Citrus Fruit Assn.—equipment for its packing house.

Ont., Kingsville—Conklin Mills, Division St.—machinery and equipment for planing mills at Amherstburg.

Que., Coleraine — The Canada Asbestos and Chrome Co., Ltd.—equipment

Que., Laprairie—The La Boulangerie du Peuple, Ltd.—equipment for proposed bake house.

Que., Macamic—The Macamic Nord, Ltd.—equipment for its proposed saw mill.

Que., Montmagny—The Malleable Foundries, Ltd.—equipment for proposed foundry.

Que., Montreal—The Taylor & Arnold Eng. Co., Ltd., 39 Olier St.—equipment for its proposed brass foundry.

Metal Working

NEW ENGLAND STATES

Conn., New Britain—S. Ginsberg, 420 Church St., has awarded the contract for the construction of a 2 story, 20 x 65 ft.

garage and repair shop, on Walnut St. Cost between $10,000 and $12,000.

Conn., New Haven — R. Bass, 23 Grove St., will build a 1 story garage on Grove St. Estimated cost, $10,000.

Conn., New Haven — D. Levine, 191 George St., will build a 1 story, 60 x 60 ft. garage on Commerce St. Estimated cost, $15,000. Noted Oct. 14.

Conn., Norwalk—The Fairbanks Storage Battery Co., 438 Atlantic Ave., Stamford, will soon award the contract for the construction of a 1 story, 50 x 150 ft. service station, on West Ave. Estimated cost, $50,000. Emmens & Abbott, Washington Bldg., Stamford, Archts.

Conn., Portland — Wilcox Crittenden & Co., Inc., 8 South Main St., Middletown, plans to build a 1 story foundry. Estimated cost, $50,000.

Conn., Terryville—The Chapman Machine Co., Main St., machinists, will soon award the contract for the construction of a 1 story, 40 x 60 ft. addition to its plant here. Estimated cost, $10,000. Sperry & Buell, 175 Main St., Bristol, Engrs.

Conn., Waterbury — J. H. Cassidy, 144 Bank St., has awarded the contract for the construction of a 1 story store and business garage on West Main and Willow Sts. Estimated cost, $75,000.

Conn., West Haven — The West Haven Mfg. Co., 22 Elm St., has awarded the contract for the construction of a 2 story addition to its hardware factory, on Elm St. Estimated cost, $10,000. Noted Oct. 28.

Mass., Beverly—P. S. Eaton, 434 Rantoul St., will soon award the contract for the construction of a 1 story, 60 x 100 ft. garage and a 31 x 46 ft. repair shop on Elliott St. Estimated cost, $35,000. Burk & Bottomley, 34 School St., Boston, Archts.

Mass., Boston—E. G. A. Isenbeck, 95 Milk St., will soon award the contract for the construction of a 2 story, 100 x 300 ft. garage, on Boylston St. J. C. Spofford, 36 Bromfield St., Archt.

Mass., Holyoke—The Worthington Pump & Mchy. Corp., 37 Appleton St., will soon award the contract for remodeling the old school house on North Bridget and East Dwight Sts., into pattern building. Estimated cost, $30,000. Private plans.

Mass., Mattapan—J. Barrett, 6 Milton St., has awarded the contract for the construction of a 1 story, 30 x 160 ft. addition to his garage on Milton and Woodrow Sts. Estimated cost, $15,000. Noted Sept. 2.

Mass., Norwood — The G. M. Lepper, Washington St., plans to build a garage on Washington St. Estimated cost, $50,000.

Mass., Springfield — Gruddell Bros., 43 Orange St., will soon award the contract for the construction of a 1 story garage on Orange St. Estimated cost, $25,000. Private plans.

Mass., Westfield—The Vitrified Wheel Co., Emery St., has awarded the contract for the construction of a 1 story, 80 x 100 ft. kiln building. Estimated cost, $50,000. Noted Oct. 21.

MIDDLE ATLANTIC STATES

N. J., Trenton—The Lenox, Inc., Mead St., plans to build a 1 story, 40 x 100 ft. garage and store house. Estimated cost, $20,000. Karno-Smith Co., Broad St. Bank Bldg., Engrs.

N. Y., Cazenovia—The Diepress Co. will build a 2 story, 60 x 150 ft. addition to its factory for the manufacture of presses. Estimated cost, $100,000. Noted June 10.

N. Y., Dunkirk — The Thomas Flexible Coupling Co. will soon award the contract for the construction of a 1 story, 40 x 200 ft. factory. Estimated cost, $50,000. Private plans.

N. Y., New York (Borough of Brooklyn) —The Estate of W. Beard, c/o Gilbert & Ashfield, Archts. and Engrs., 350 Fulton St., has awarded the contract for the construction of a 1 story, 150 x 160 ft. garage on Richardson St. Estimated cost, $60,000.

N. Y., New York (Borough of Brooklyn) —I. Carlson, c/o Cohn Bros., Archts. and Engrs., 361 Stone Ave., will build a 1 story, 100 x 100 ft. garage on Flushing Ave. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn) —H. Jenkins, 550 73rd St., will build a 1 story, 100 x 150 ft. garage on 39th St. Estimated cost, $45,000.

N. Y., New York (Borough of Brooklyn) —Linn-Cook Corp., c/o B. Driesler, Archt. and Engr., 153 Remsen St., will build a 1 story, 100 x 200 ft. garage on 35th St. near 4th Ave. Estimated cost, $75,000.

N. Y., New York (Borough of Brooklyn) —F. Richards, 3337 Atlantic Ave., will build a 1 story, 95 x 100 ft. garage on Atlantic Ave. Estimated cost, $90,000.

N. Y., New York (Borough of Brooklyn) —Segal & Schorr, 180 South 4th St., will build a 1 story, 75 x 100 ft. garage on Bway. Estimated cost, $30,000.

N. Y., New York (Borough of Manhattan)—D. Kraus, c/o J. P. Whiskeman, Archt. and Engr., 153 East 40th St., is having plans prepared for the construction of a 2 story, 100 x 150 ft. garage, on 126th St. and Bway.

N. Y., New York (Borough of Manhattan)—E. Sagel, c/o C. B. Meyers, Archt. and Engr., 1 Union Sq., will build a 1 story, 105 x 135 ft. garage, at 544 West 133d St. Estimated cost, $35,000.

N. Y., New York (Borough of Manhattan)—E. Stevens, c/o Dunnigan & Crumley, Archts. and Engrs., 394 East 150th St., will build a 1 story, 50 x 170 ft. garage on Wallen Ave. Estimated cost, $45,000.

N. Y., New York (Borough of Manhattan)—The Webb Bldg. Corp., c/o Moore & Landseidel, Archts. and Engrs., 3d Ave. and 148th St., will build a 1 story, 100 x 150 ft. garage on Park Ave. and 174th St. Estimated cost, $50,000.

N. Y., Syracuse—The Syracuse Fire Door Co., Beech and Canal Sts., is building a 1 story, 51 x 116 ft. factory for the manufacture of fire doors. Estimated cost, $10,000.

Pa., Lewistown—The Keystone Motor Co., Main and 3rd Sts., will build a 2 story, 187 x 201 ft. garage. Estimated cost, $100,000. Noted Aug. 10.

Pa., Philadelphia—A. Pestone, 1625 South 8th St., is having plans prepared for the construction of a 2 story, 50 x 120 ft. garage at 705 Tasher St. Cost to exceed $10,000. J. E. Fieldstein, Penfield Bldg., Archt.

Pa., Pittsburgh—J. Douglass, c/o Rutan & Russell, Archts., Century Bldg., will soon award the contract for the construction of a 1 story, 30 x 320 ft. garage on Duquesne Way and Sandusky St. Estimated cost, $30,000.

Pa., Pittsburgh—Heyl & Patterson, manufacturers of conveying machinery, 51 Water St., has awarded the contract for altering and building a 4 story addition to the present buildings on 1st Ave. and Water St. Estimated cost, $85,000.

Pa., Pittsburgh — The Pittsburgh Truck Mfg. Co., 609 Neville St., is having plans prepared for the construction of a 1 and 2 story, 100 x 100 ft. garage and repair shop. Estimated cost, $75,000. C. W. Hodgson, Martin Bldg., Archt.

SOUTHERN STATES

La. New Orleans—The Marine Iron Wks., 1008-1014 Magazine St., plans to build a 73 x 113 ft. machine, boiler and blacksmith shop. Estimated cost, $75,000. J. de Tarnowsky, 602 Canal Book Annex, Archt. and Structural Engr.

N. C., Wilmington—The Simons Mfg. Co., manufacturers of furnace grates for boilers, plans to build a plant here. Cost to exceed $200,000.

W. Va., Huntington — The International Nickel Co., 43 Exch. Pl., New York City, will build a rolling mill plant. Estimated cost, $3,000,000.

MIDDLE WEST

Ill., Chicago—J. F. Marz, 5131 Bway., has awarded the contract for the construction of a 1 story, 50 x 150 ft. auto sales and service building. Estimated cost, $100,000.

Ill., Chicago—The U. S. Auto Supply Co., 3845 South Wabash Ave., plans to construct a 1 story, 75 x 150 ft. addition to its garage at 3847 South Wabash Ave. Estimated cost, $45,000. Levy & Klein, 111 West Washington St., Archts.

Ind., Anderson—The Lavelle Fdry Co. is building a factory for the manufacture of gray iron castings. J. F. Stanley, 1225 North Alabama St., Indianapolis, Engr.

Ind., Lebannon — The Indestructible Wheel Co. plans to build a 90 x 150 ft. factory for the manufacture of steel wheels for passenger cars and motor trucks. Estimated cost, $75,000. A. M. Lofland, Secy. and Treas.

Mich., Bay City—The Wildman Rubber Co., 816 Book Bldg., Detroit, is having plans prepared for the construction of a 3 story, 80 x 110 ft. factory. Estimated cost, $250,000. J. E. McCable, Secy. Osborne Eng. Co., 2838 Prospect Ave., Cleveland, O., Archts. and Engrs.

Mich., Brighton — The Grove Motor Co. plans to build a 1 story, 80 x 200 ft. factory for the manufacture of auto parts. Estimated cost, $50,000. W. C. Boyer, Brighton, Engr.

O., Ashtabula — The Pierce, Butler & Pierce Mfg. Co., 282 James St., Syracuse, N. Y., will probably build a plant here, for the manufacture of furnaces, radiators, etc. Estimated cost, $1,000,000.

O., Cleveland—The Cyclone Fence Co., 1209 Marquette Rd., has awarded the contract for the construction of a 2 story, 50 x 64 ft. garage and office building. Estimated cost, $30,000.

O., Cleveland—The Globe Motors Co., c/o C. H. Davies, 1132 Guardian Bldg., has awarded the contact for the construction of a 1 story, 100 x 500 ft. factory on Chardon Rd. Estimated cost, $300,000. Noted Oct. 7.

O., Cleveland — J. Kalika Garage, 3226 West 46th St., has awarded the contract for the construction of a 40 x 80 ft. garage at 3273 West 46th St. Estimated cost, $10,000.

O., Cleveland — H. O'Neil, 1330 Oregon Ave., has awarded the contract for the construction of a 1 story, 60 x 120 ft. garage on Oregon Ave. Estimated cost, $50,000.

O., Cleveland—Parish & Bingham, 11600 Madison Ave., manufacturers of castings, has awarded the contract fo the construction of a 1 story, 24 x 45 ft. heating room. Estimated cost, $10,000.

O., Marsfield—The Superior Brass Mfg. Co. is building a 40 x 60 ft. addition to its brass foundry. E. K. Bacon, Secy.

O., New Philadelphia — The Ladel Mfg. Co. (operating machine shop) is having plans prepared for the construction of a 1 story, 85 x 300 ft. factory. Estimated cost, $75,000.

O., Sidney—The Wagner Mfg. Co. has awarded the contract for the construction of a 1 story, 80 x 180 ft. addition to its foundry. Estimated cost, $75,000. Noted Oct. 14.

O., Youngstown — The Reserve Iron & Steel Co. plans to build 2 blast furnaces and a 2,000,000 ton puddling plant. Estimated cost, $1,000,000.

O., Warren—The Warren Metallic Bed Co. is having sketches made for the construction of a 2 story factory. Estimated cost, $100,000.

Wis., Antigo—The Antigo Tractor Co. has purchased a site on North Edison St. and plans to build a 150 x 200 ft. tractor factory. Estimated cost, $200,000. C. W. Fish, Pres.

Wis., Benton — T. J. McCarthy has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage and theatre. Estimated cost, $25,000.

Wis., Drummond—The Rust Owen Lumber Co. is having preliminary plans prepared for the construction of a garage. R. E. Gilchrist, Secy.-Treas. G. L. Nason, 641 Endicott Bldg., St. Paul, Minn., Archt.

Wis., Rice Lake—The New Idea Potato Mchy. Co. will soon award the contract for the construction of a 3 story, 80 x 130 ft. factory on Main St., for the manufacture of potato machinery. Estimated cost, $40,000. Private plans.

Wis., West Bend — The Miller Spouting Co. will soon award the contract for the construction of a 3 story, 60 x 85 ft. factory. Estimated cost, $30,000. Private plans.

WEST OF THE MISSISSIPPI

Kan., Pittsburg—The F. C. Werren and M. E. Coffey have awarded the contract for the construction of a 2 and 3 story, 100 x 108 ft. garage on 4th and Locust Sts. Estimated cost, $85,000.

CANADA

Ont., London—The Stansell Motors Ltd., Amherstburg, has purchased a 35 acre site here, in the eastern section of the city, and plans to build an auto factory.

Ont., London—T. Terry, 150 Maple St., plans to build a 1 story, 50 x 80 ft. machine shop on Maple St. Estimated cost, $25,000.

Ont., Toronto—The Crouse Hinds Co. of Canada and Harvey-Hubbell Co., 7 Labatt Ave., and the Hubbell-Mack Machine Screws Co., have purchased a 5 acre site on Coxwell Ave. and plans to build a 3 story factory for the manufacture of electric fixtures, machine screws, etc. Estimated cost, $500,000.

Que., Montmagny—The Malleable Foundries Ltd. will receive bids about Nov. 15 for the construction of a foundry. Estimated cost, $75,000.

Que., Montreal—The Mountain Street Garage Co. has awarded the contract for the construction of a 2 story, 89 x 138 ft. garage. Estimated cost, $60,000. Noted Nov. 4.

Que., Montreal—The Taylor & Arnold Eng. Co., Ltd., 39 Oiler St., plans to build a brass foundry.

General Manufacturing

NEW ENGLAND STATES

Conn., Amston—The New Haven Dairy Co., 201 Hazel St., New Haven, has awarded the contract for the construction of a 1 story, 50 x 100 ft. milk plant. Cost between $25,000 and $30,000.

Conn., Hartford—The Travelers Insurance Co., 700 Main St., has awarded the contract for the construction of a printing plant, on Albany Ave. Estimated cost, $1,000,000. Noted Oct. 21.

Mass., Holyoke—The Amer Writing Paper Co., 9 Main St., will build a 1 story, 25 x 75 ft. addition to its paper factory. Estimated cost, $25,000.

Mass., Palmer—The Thorndike Co. plans to build a 3 story, 120 x 300 ft. dye house. Estimated cost, $350,000. Leary & Walker, Times Bldg., New Bedford, Engrs.

Mass., Worcester—Tait Bros., Cass St., Springfield, will soon award the contract for the construction of a 3 story, 60 x 120 ft. ice cream manufacturing plant on Shrewsbury St. Estimated cost, $75,000. H. E. Geckler, 335 St. James Ave., Springfield, Archt.

N. H., Tilton—The General Optical Co., 356 Washington St., Mount Vernon, N. Y., is having plans prepared for the construction of an addition to its plant here. Estimated cost, $50,000. Woodell & Ressler, 501 5th Ave., New York City, Archts. and Engrs. Noted Nov. 4.

MIDDLE ATLANTIC STATES

N. J., Hoboken—The Chocolate Menier Co., 1127 Clinton St., has awarded the contract for the construction of a 2 story factory. Estimated cost, $125,00.

N. J., Newark—The New York Auto Top Co., 262 Halsey St., is having plans prepared for the construction of a 2 story, 26 x 118 ft. factory on Astor and Broad Sts. Estimated cost, $50,000. Bachoff, Jones & Cook, 9 Clinton St., Archts.

N. J., Trenton—The Star Porcelain Co., Muirheid Ave., has awarded the contract for the construction of a 2 story, 40 x 80 ft. addition to its factory. Estimated cost, $6,500.

N. Y., New York (Borough of Brooklyn)—The Grand Corrugated Paper Co., 30 Crosby St., New York City, has awarded the contract for its 1 story factory on 32d St., here.

N. Y., New York—Borough of Manhattan)—P. Schuldeberger will alter his 5 story factory at 52 Cliff St., for the manufacture of bristles. Estimated cost, $35,000.

N. Y., New York (Borough of Queens)—Rachman Bros., Inc., 260 Johnson Ave., Long Island City, have awarded the contract for the construction of a 1 story, 50 x 100 ft. factory, on Johnson Ave., for the manufacture of bags. Estimated cost, $35,000.

N. Y., Rochester—The Genesee Brewery (Bartholomay Co., owner) is converting its brewery into a vegetable oil plant, to have a daily capacity of 50 tons. Estimated cost, $100,000. H. E. Brown, 115 Bway., New York City, designer and superintending engineer.

Pa., Cresson—The Penn Cress Ice Cream Co. will soon award the contract for the construction of a 2 story, 48 x 91 ft. ice cream plant on Park Ave. Estimated cost, $50,000. McCormick Co., Century Bldg., Pittsburgh, Archt. Noted Oct. 21.

Pa., Philadelphia—The Harbisons Dairies, Front and Diamond Sts., have awarded the contract for the construction of a 2 story, 80 x 196 ft. dairy plant and boiler room, on Huntington Park and Torresdale Ave. Estimated cost, $240,000.

Pa., Williamsburg—B. W. Mosteller, East Liberty, has purchased a 3 story, 50 x 104 ft. building on 4th St., here, and plans to rebuild and equip same for the manufacture of ice cream.

SOUTHERN STATES

Fla., Jacksonville—The Wilson Toomer Fertilizer Co., Viaduct, plans to build a plant to replace the old one which was recently destroyed by fire. Cost to exceed $1,000,000. N. M. G. Prange, Mgr.

La., New Orleans—G. B. Matthews & Son, 420 South Front St., manufacturers of flour and grain, etc., plans to build a 3 story factory on a site bounded by Cortez, Telemachus and Scott Sts, between Bienville and Conti Sts.

N. C., Greensboro—The Piedmont Ice & Coal Co. plans to build an ice plant. Estimated cost, $75,000.

N. C., Wilmington—The Fisheries Products Co. plans to build a fertilizer plant. Estimated cost, $100,000.

W. Va., Morgantown—B. M. Chaplin & Co. will build a 1 story lumber yard and mill. Cost between $6,000 and $8,000. D. E. Adams, Secy.

MIDDLE WEST STATES

Ill., Chicago—The New Way Laundry, c/o Ronneberg Pierce & Hauber, Archts., 10 South La Salle St., will soon award the contract for the construction of a 2 story, 64 x 152 ft. steam laundry, on Montrose and Francisco Sts.

Ind., Elkhart—The Wawasee Tire & Rubber Co. will soon award the contract for the constructon of a 4 story, 175 x 175 ft. factory. Estimated cost, $500,000. R. L. Simmons, Elkhart, Archt.

Ind., Ft. Wayne—Griffith & Goodrich, Archts., Physicians Defense Bldg., will receive bids about Nov. 25, for the construction of a 1 and 2 story, 60 x 180 ft. factory on Cochrane St., for the Amer. Textile Art Printing & Dyeing Co., 403 West Jefferson St. Estimated cost, $40,000.

Ind., Richmond—The Richmond Baking Co. has awarded the contract for the construction of a 5 story, 50 x 125 ft. bakery. Estimated cost, $175,000.

Mich., Detroit—Orling Bros., Heidelberg and Elmwood Aves., are having plans prepared for the construction of a 3 story, 60 x 100 ft. factory on Heidelberg Ave., for making sausage, etc. Estimated cost, $200,000. L. Kamper, 751 Book Bldg., Archt.

O., Cleveland—The J. A. C. Broom & Brush Co., 2339 East 89th St., plans to build a 2 story, 50 x 100 ft. factory. Estimated cost, $40,000. L. H. Joy, Mgr.

O., Cleveland—The Folding Box Co., 1900 West 3rd St., has awarded the contract for the construction of a 1 story, 100 x 250 ft. factory. Estimated cost, $100,000. Noted Oct. 28.

O., Cleveland—Malay Rubber Co., c/o C. Blatz, 1035 Guardian Bldg., plans to build a 3 story factory on East 172d St. and St. Clair Ave. Estimated cost, $100,000.

O., Cleveland—The Mazzolini Statuary Co., 4424 Payne Ave., plans to build a 2 story, 24 x 60 ft. factory on East 66th St. and St. Clair Ave. Estimated cost, $25,000. Private plans.

O., Cleveland—The Noss Baking Co., 4706 Lorain Ave., has awarded the contract for the construction of a 1 story, 16 x 24 ft. addition to its bakery. Estimated cost, $10,000.

O., Youngstown—The Bd. Educ. is having plans prepared for the construction of a school to be known as the Rayen School. Plans include a chemistry and physics laboratory and a wood and metal work shop.

Wis., Milwaukee—G. Kashou, 432 Jefferson St., will soon award the contract for the construction of a 2 story, 45 x 65 ft. rug cleaning plant, on Farwell Ave. C. W. Valentine, Bway. Bldg., Archt. Noted Nov. 4.

Wis., Racine—The New York Market Co., 1015 16th St., will soon receive bids for the construction of a 2 story, 96 x 110 ft. sausage factory. Packers Architectural & Eng. Co., 431 South Dearborn St., Chicago, Archts. and Engrs.

Wis., Random Lake—The Dehydrated Meat & Milk Co., c/o M. Friess, St. Paul, has purchased a site on Main St., here, and plans to build a 60 x 250 ft. dehydrating milk factory. Estimated cost, $100,000.

WEST OF THE MISSISSIPPI

Col., Greeley—The Colorado Milling & Elevator Co., 1441 7th St., Denver, is having plans prepared for the construction of a 600 barrel flour mill. Estimated cost, $350,000.

Minn., Fridley—The Walsh Tie Co., 954 McKnight Bldg., Minneapolis, has awarded the contract for the construction of a creosoting plant, to include a 1 story office building, factory, powder-house, retort tanks, etc. H. S. Gilkey, Secy. and Treas.

Minn., Northfield—The Theobald Flour Mills plan to construct a group of buildings, including a feed mill, warehouse and 8 storage tanks. Estimated cost, $100,000.

Minn., Virginia—The Bd. Educ. plans to build two 2 story, 150 x 250 ft. grade schools, each to contain manual training and domestic science departments. Estimated cost, $600,000. R. G. McKee, chn.

Tex., Dallas—The Lincoln Paint & Color Co., Detroit, Mich., has awarded the contract for the construction of the 1st unit of its paint factory, to be 2 story, 140 x 180 ft., on Kentucky and Ash Lane. Estimated cost, $150,000.

WESTERN STATES

Cal., Anaheim—The Anaheim Citrus Fruit Assn. will build a 1 story, 100 x 132 ft. orange packing house. Estimated cost, $75,000.

Idaho, Idaho Falls—The Howard Pulp & Paper Co. is having plans prepared for the construction of a news print plant, to include a power house. Estimated cost, $4,000,000. T. L. Tomlinson, City Bank Bldg., Syracuse, N. Y. Engr.

Wash., Tacoma—The Olympic Ice & Machine Co., 612 East 25th St., plans to build a 4 story, 100 x 130 ft. ice plant. Estimated cost, $125,000.

CANADA

B. C., Westminster—The Acetate Products Co., Ltd., plans to build a wood products plant. P. A. Carleton, Supt. in charge. Estimated cost, $50,000.

Ont., London—The Harris Abattoir Co., Union Stock Yards, Toronto, has purchased a site on Talbot St., here, and plans to build an abattoir. Estimated cost, $100,000.

Que., Laprairie—The La Boulangerie du Peuple, Ltd., will soon receive bids for the construction of a bake house. Estimated cost, $45,000.

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